LAB.GRUPPEN

fP3400

SERVICE MANUAL

Version 2

Lab.gruppen AB
Gullregnsvägen 16, SE-434 44 KUNGSBACKA, SWEDEN
Phone: +46 300 56 28 00
Fax: +46 300 56 28 99
info@labgruppen.com
www.labgruppen.com

fP3400

A20TDH

A20TDL

IN2GTD

LD92

SP80CB

SP80FA / SP80FB

Functional description for class TD amplifiers

Theory of function

The input signal is connected to the balanced amplifier and gain switch U1, U201 on the IN2GTD-board. The signal is then passing the gain control on the front panel, going to amplifier U2 (IN2GTD). The gain in this amplifier can be reduced by opto resistor U5 to prevent clipping in the output amplifier. Limiter Q1, Q2 together with the phase linear lowpassfilter U3, U4 limits the slewrate of the signal going to the output amplifier A20TDL, preventing intermodulation in this amplifier if signals of too high frequencies are presented on the input terminal.

The output amplifier A20TDL works as an ordinary power amplifier with the difference that the collector voltage to the output transistors is supplied from the switch mode amplifier A20TDH. The base voltage of the output transistors Q26-Q28, Q31-Q33 (A20TDL) is sensed by voltage divider R36-R38 and is then sent to the adjustable limiter U3, U4 on the IN2GTD-board, before it reaches the input of the switch mode amplifier (A20TDH) . Limit level is set by the MLS switches S1 and S2. This limiter is used to limit the maximum output voltage from the amplifier. These switches also change the sensitivity for the led bars on the front panel.

The amplifier U1 (U2) on the A20TDH-board makes sure that the output signal on terminal CP4 (CP8) is a copy of the input signal on terminal CP12, by giving correct control voltage to pulse width modulator U3. U3 compares this voltage with an 614kHz triangular wave giving a pulse width modulated output signal from Q1 (Q7) which is filtered by L1, C1 (L4, C10). The gain from the base of the output transistors on the A20TDL-board to the output of the A20TDH-board is equal to one. VR1 (VR2) is used to add a DC-offset on the input of U1 (U2) giving +7,5V (CP4) -7,5V (CP8) relative output of the LF-amplifier (CP6A), which is the same as collector-emitter voltage for the output transistors Q26-Q28 and Q31-Q33.

Repairing instructions

REQUIRED MEASUREMENT EQUIPMENT:
-Audio generator
-Dummy load, 16 ohm
-AC-voltmeter/THD-meter
-2 digital voltmeters
-Two channel oscilloscope for audio

1. Without changing any fuses check the power supply +155V, -155V, +16V, -16V and +45V. If these aren't OK go to the service manual for the power supply. (The +45V voltage is not regulated and can vary between 30 and 60V depending on the load of the power supply.)

2. If all fuses are OK, follow the signal from input to output, and repair in normal way. The best way is to place the amplifier on the front handles, loosen the rear panel, and mount it back on distances (delivered with this manual) to make it possible to measure.

3. If there is a fault in the power amplifier stage do as follows:

   3:1 Turn VR1, VR2 (A20TDH) and VR3 (SP80FB) counter clockwise.

   3:2 Short-circuit R38 on A20TDL-board.

   3:3 Disconnect cables from CP23 and CP24 (A20TDL) (Q26-Q28 and Q31-Q33 collectors).

   3:4 Replace broken fuses. (only for the channel you repair)

   3:5 Connect DC-voltmeter (200V) to the positive (negative) rail voltage.

   3:6 Connect another DC-voltmeter (20V) to the cable disconnected from CP23 (CP24).

   3:7 Turn VR3 (SP80FB) slowly clockwise, and watch the voltmeters. Rail voltage should increase rapidly, "collector voltage" should read 0. After turning VR3 maximum 30°, rail voltage should be 155V.

a) If the rail voltage is zero or very low, check Q1, D1A, D1B (Q7, D5A, D5B) (shorted) on the A20TDH-board. If Q1 (Q7) is broken, also replace R3 (R16) and D2 (D6).

b) If the rail voltage is OK, turn VR1 (VR2) on the A20TDH-board slowly maximum clockwise. Voltage measured on the disconnected collector cable should stop at about 7,5V.

c) If OK turn VR1 (VR2) (A20TDH) and TP3 (SP80FB) counter clockwise.

3:8 Repeat from 3:5 for the negative side.

3:9 Reconnect cable to CP23 (Q26-Q28 collector).

3:10 Connect dummy load 16 ohm to output, and connect an oscilloscope (10V/div) across the load.

3:11 Slowly turn VR3 (SP80FB) for 155V (-155V) rail voltage.

3:12 Slowly turn VR1 (VR2) (A20TDH) clockwise and look at the oscilloscope. There should be no DC on the oscilloscope. If there is DC (>1V) repair the positive (negative) output section on the A20TDL-board.

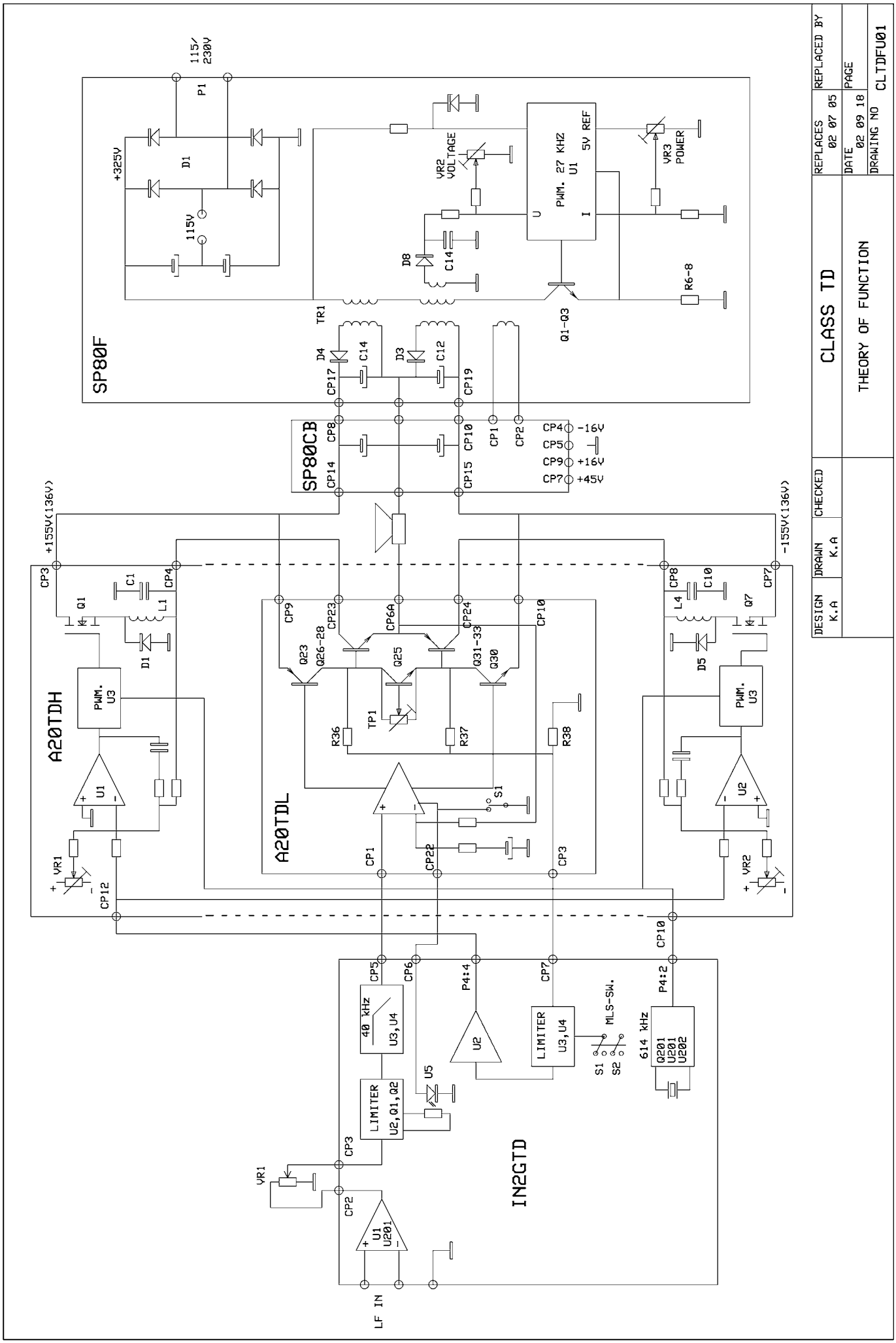
3:13 Turn back VR1 (VR2) (A20TDH) and VR3 (SP80FB), and disconnect the cable from CP23 (Q26-Q28 collector).

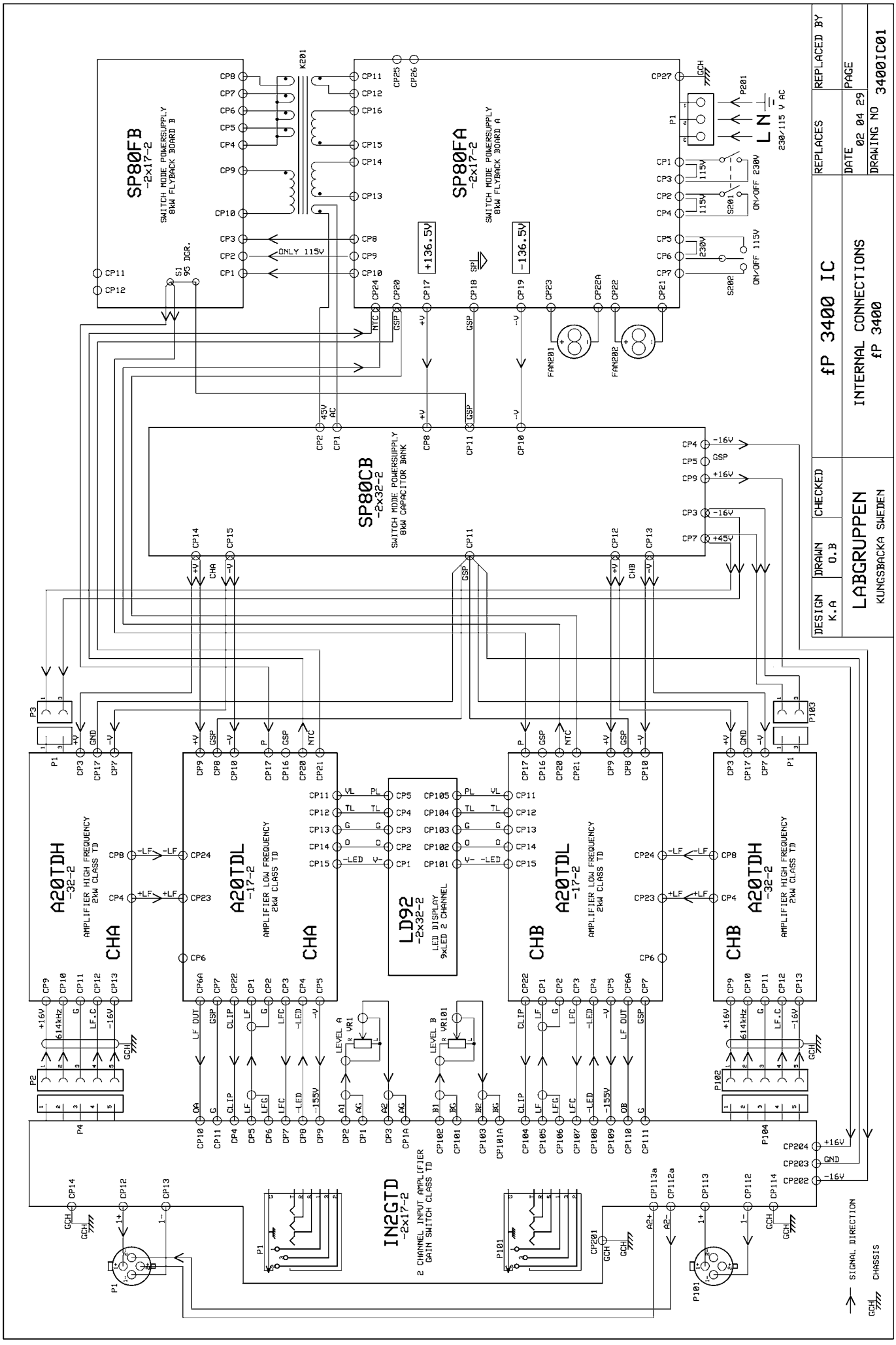
3:14 Reconnect cable to CP24 (Q31-Q33 collector) and repeat from 3:11 for the negative side.

3:15 Reconnect cables to CP23 and CP24. Turn VR3 for 155V rail voltage. Turn VR1 clockwise, no DC on the oscilloscope. Then slowly turn VR2 clockwise. There can be some oscillation with VR2 in middle position, but it will stop at further turning.

3:16 Connect 1kHz sine wave to the input of the amplifier. Adjust gain until there is signal on the output. It should be a 7V PK sine wave with no distortion.

3:17 Disconnect short circuit from R38, and the amplifier will work.


SP80F
SP80CB
A20TDH
A20TDL
IN2GTD
CLASS TD
THEORY OF FUNCTION
CLTDFU01
REPLACED BY
REPLACES 02 07 05
DATE 02 09 18
PAGE
DRAWING NO
DESIGN K.A
DRAWN K.A
CHECKED
115V 230V
+325V
115V
P1
D1
PWM. 27 KHZ U1
5V REF
VR2 VOLTAGE
VR3 POWER
D8
C14
R6-8
TR1
Q1-Q3
D4
D3
C12
CP17
CP19
CP8
CP10
CP1
CP2
CP4 -16V
CP5
CP9 +16V
CP7 +45V
CP14
CP15
+155V(136V)
-155V(136V)
CP3
C1
L1
Q1
PWM. U3
U1
VR1
CP12
CP9
CP23
CP6A
CP24
CP10
Q23
Q26-28
Q25
Q31-33
Q30
TP1
R36
R37
R38
S1
CP1
CP22
CP3
C10
L4
Q7
D5
U2
VR2
CP8
CP7
40 kHz
U3,U4
CP5
CP6
P4:4
P4:2
CP7
LIMITER
U2,Q1,Q2
U5
LIMITER
U3,U4
MLS-SW.
S1
S2
614 kHz
Q201
U201
U202
U1
U201
LF IN


fP 3400 IC
INTERNAL CONNECTIONS
fP 3400
LABGRUPPEN
KUNGSBACKA SWEDEN
DESIGN K.A
DRAWN O.B
CHECKED
REPLACES
REPLACED BY
DATE 02 04 29
PAGE
DRAWING NO 34001C01
SP80FB -2x17-2
SWITCH MODE POWERSUPPLY 8kW FLYBACK BOARD B
SP80FA -2x17-2
SWITCH MODE POWERSUPPLY 8kW FLYBACK BOARD A
SP80CB -2x32-2
SWITCH MODE POWERSUPPLY 8kW CAPACITOR BANK
A20TDH -32-2
AMPLIFIER HIGH FREQUENCY 2kW CLASS TD
A20TDL -17-2
AMPLIFIER LOW FREQUENCY 2kW CLASS TD
LD92 -2x32-2
LED DISPLAY 9xLED 2 CHANNEL
IN2GTD -2x17-2
2 CHANNEL INPUT AMPLIFIER GAIN SWITCH CLASS TD
+136.5V
-136.5V
ONLY 115V
230/115 V AC
ON/OFF 230V
ON/OFF 115V
SIGNAL DIRECTION
CHASSIS

Component list

⚠ - Safety critical component. Should only be replaced with the specified type.

	Position	Partnumber	Description	Comment
⚠	FAN201	F80x25-24HS	Fan 80x80x25mm 24VDC high speed	
⚠	FAN202	F80x25-24HS	Fan 80x80x25mm 24VDC high speed	
⚠	K201	3K4FUI9330_LAB	Trafo. 3,4KW flyback U93/76/30 I93/28/30 core LAB. Rev01	
⚠	P1	NL4MP_NEU	Connector speakon 4pole NEUTRIK NL4MP	
⚠	P2	CASOC5P270_LAB	Cable assembly socket crimp terminal 5pole L270mm LAB. Rev01	
	P3	SOIDC3P1M_AMP	Socket IDC terminal 3pole 1module AMP 640441-3	
⚠	P101	NL4MP_NEU	Connector speakon 4pole NEUTRIK NL4MP	
⚠	P102	CASOC5P270_LAB	Cable assembly socket crimp terminal 5pole L270mm LAB. Rev01	
	P103	SOIDC3P1M_AMP	Socket IDC terminal 3pole 1module AMP 640441-3	
⚠	P201		Variant dependent, see separate list	
⚠	P201A		Variant dependent, see separate list	
⚠	S201		Variant dependent, see separate list	
⚠	S202		Variant dependent, see separate list	
	VR1	VR10KLIN31_TOK	Potentiometer 10K LIN 31step TOKOS B103 TP96N08 Y4929 Rev1	
	VR101	VR10KLIN31_TOK	Potentiometer 10K LIN 31step TOKOS B103 TP96N08 Y4929 Rev1	

Variant specific components

	Position	230V	115V
⚠	P201	MLEU3x1.52.5mBLK	SJOOW-3xAWG12
⚠	P201A	-	MP5-15P15A125V
⚠	S201	RK2-0-10A15x21	-
⚠	S202	-	RK1-1-6A15x21

Description for variant dependent components

Partnumber	Description
MLEU3x1.52.5mBLK	Mains lead EU Plug type CEE7/VII 3x1.5mm2 2.5m Black
MP5-15P15A125V	Mains plug type 5-15P 15A 125V
RK1-1-6A15x21	Switch Rocker Single Pole Double Trough on - on 6A 15x21mm
RK2-0-10A15x21	Switch Rocker Double Pole Single Trough on - off 10A 15x21mm
SJOOW-3xAWG12	Cable SJOOW 3xAWG12 UL style 817

Sparepart list for fP3400

Completed modules

Partnumber	Description
A20TDH-32-2	Amplifier high frequency 2kW class TD, variant 32-2
A20TDL-17-2	Amplifier low frequency 2kW class TD, variant 17-2
IN2GTD-2x17-2	2 channel input amplifier and gainswitch class TD, variant 2x17-2
LD92-2x32-2	Led display 9 x led 2 channel, variant 2x32-2
SP80CB-2x17-2	Switch mode powersupply 8kW capacitor bank, variant 2x32-2
SP80FA-2x17-2	Switch mode powersupply 8kW flyback board A, variant 2x17-2, 230V
SP80FA-2x17-2U	Switch mode powersupply 8kW flyback board A, variant 2x17-2U, 115V
SP80FB-2x17-2	Switch mode powersupply 8kW flyback board B, variant 2x17-2, 230V
SP80FB-2x32-2U	Switch mode powersupply 8kW flyback board B, variant 2x17-2U, 115V

Mecanical parts

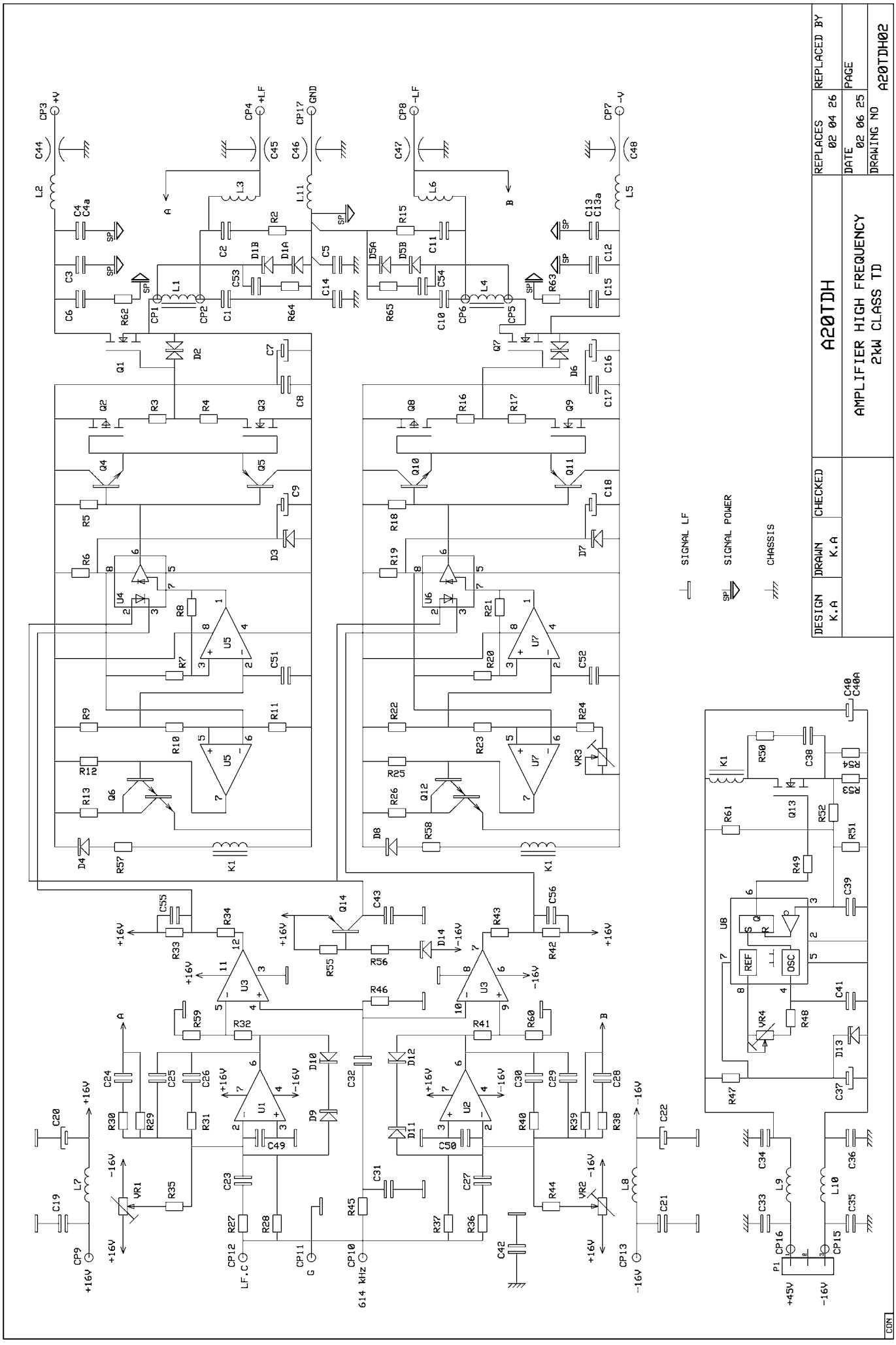
⚠ - Safety critical component. Should only be replaced with the specified type.

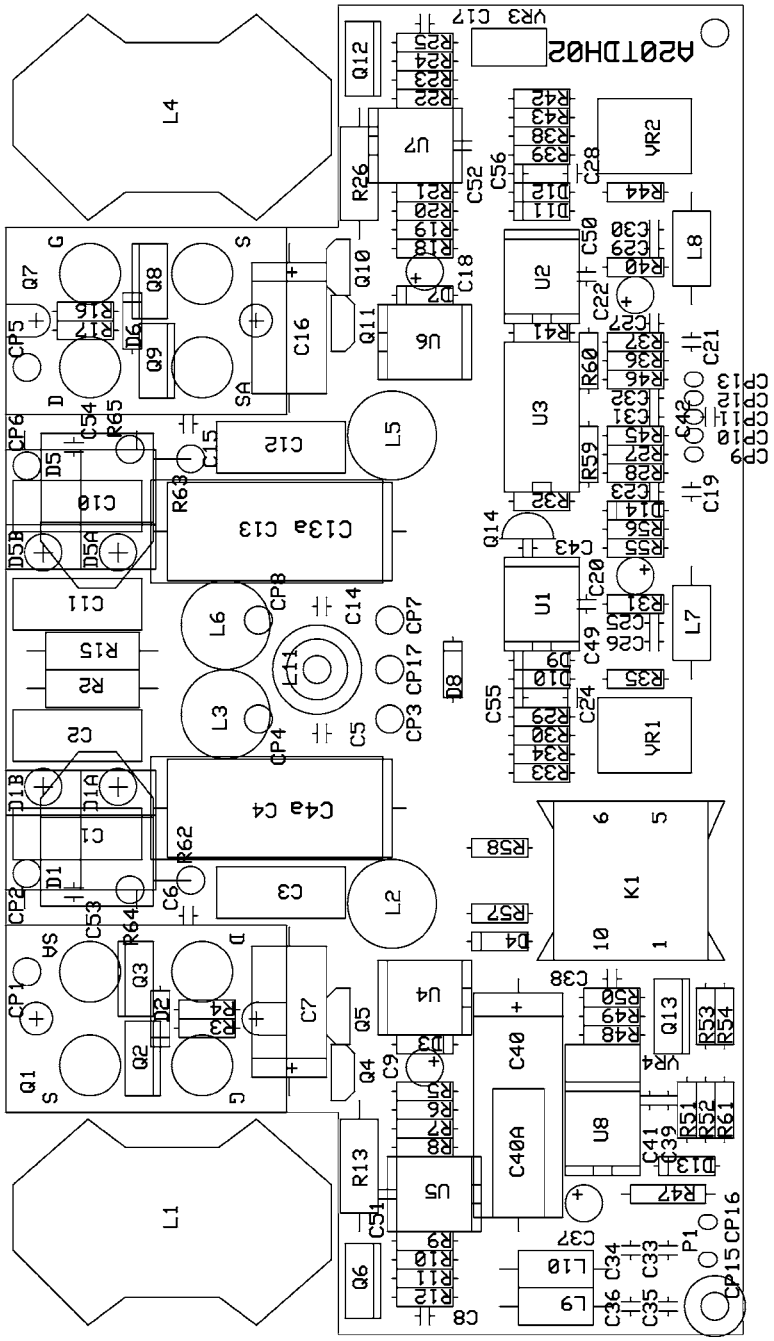
Partnumber	Description
TCA20TDA-PBLK	Top / bottom cover
FP-FP3400	Front panel
SPLA20TDA-A	Side panel left
SPRA20TDA-A	Side panel right
RP-FP3400	Rear panel 230V
RP-FP3400U	Rear panel 115V
HDL2HEM5_MEN	Handle
DCSL1-PBLK	Dustfilter clip left
DCSR1-PBLK	Dustfilter clip right
DF139x62x5-20 ⚠	Dustfilter left
DF115x62x5-20 ⚠	Dustfilter right
KNBD18.5_TAI	Gain potentiometer knob

Screws

Partnumber	Description
MRX3x10SV	Machine screw, pan head, phillips, M3x10, black
MFX3x12SV	Machine screw, countersunk head, phillips, M3x12, black
MFX3x20SV	Machine screw, countersunk head, phillips, M3x20, black
RTS-HST2.9x9.5SV	Self tapping screw, pan head, torx, 2.9x9.5mm, black
MC6S4x10FBB-SV	Hexagon socket screw, cap head, M4x10 with spring washer, black
LAB_T3x8-SV	Top / bottom cover screw, torx, M3x8, black

A20TDH


A20TDH
AMPLIFIER HIGH FREQUENCY
2kW CLASS TD
DESIGN K.A
DRAWN K.A
CHECKED
REPLACES 02 04 26
DATE 02 06 25
DRAWING NO A20TDH02
REPLACED BY
PAGE
SIGNAL LF
SIGNAL POWER
CHASSIS
+V
+LF
GND
-LF
-V
LF.C
G
614 kHz
+45V
-16V
+16V



DESIGN K.A	DRAWN K.A	CHECKED	A20TDH	REPLACES 02 04 30	REPLACED BY
			AMPLIFIER HIGH FREQUENCY 2kW CLASS TD	DATE 02 06 25	PAGE
				DRAWING NO	A20TDH02-P

Component list for A20TDH-32-2 - rev 02

⚠ - Safety critical component. Should only be replaced with the specified type.

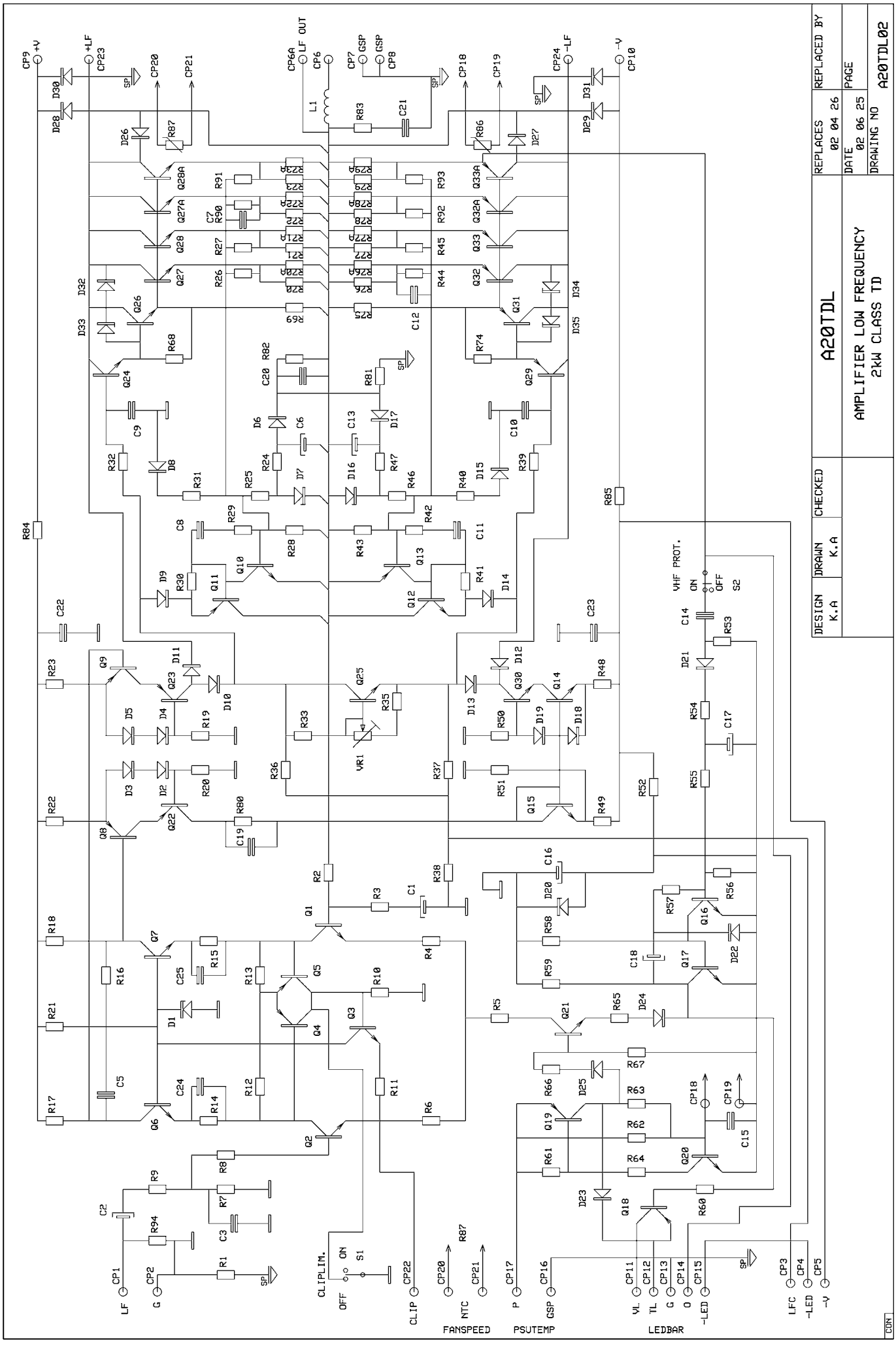
	Position	Partnumber	Description	Comment	Side
	C1	330n250VMMK15	Capacitor polyester 330n 250V MMK 15mm		Top
	C2	330n250VMMK15	Capacitor polyester 330n 250V MMK 15mm		Top
	C3	330n250VMMK15	Capacitor polyester 330n 250V MMK 15mm		Top
⚠	C4	3u3160VMKP27.5	Capacitor polypropylene 3u3 160V MKP 27.5mm	May have different value	Top
	C5	1u50VMMK5	Capacitor polyester 1u 50V MMK 5mm		Top
	C6	4n7200VX7R5%5	Capacitor ceramic 4n7 200V X7R 5% 5mm		Top
	C7	470u10V10x18A	Capacitor electrolytic 470u 10V 10x18mm axial		Top
	C8	100n63VMMK5	Capacitor polyester 100n 63V MMK 5mm		Top
	C9	10u50V	Capacitor electrolytic 10u 50V 5mm		Top
	C10	330n250VMMK15	Capacitor polyester 330n 250V MMK 15mm		Top
	C11	330n250VMMK15	Capacitor polyester 330n 250V MMK 15mm		Top
	C12	330n250VMMK15	Capacitor polyester 330n 250V MMK 15mm		Top
⚠	C13	3u3160VMKP27.5	Capacitor polypropylene 3u3 160V MKP 27.5mm	May have different value	Top
	C14	1u50VMMK5	Capacitor polyester 1u 50V MMK 5mm		Top
	C15	4n7200VX7R5%5	Capacitor ceramic 4n7 200V X7R 5% 5mm		Top
	C16	470u10V10x18A	Capacitor electrolytic 470u 10V 10x18mm axial		Top
	C17	100n63VMMK5	Capacitor polyester 100n 63V MMK 5mm		Top
	C18	10u50V	Capacitor electrolytic 10u 50V 5mm		Top
	C19	100n63VMMK5	Capacitor polyester 100n 63V MMK 5mm		Top
	C20	10u50V	Capacitor electrolytic 10u 50V 5mm		Top
	C21	100n63VMMK5	Capacitor polyester 100n 63V MMK 5mm		Top
	C22	10u50V	Capacitor electrolytic 10u 50V 5mm		Top
	C23	2n2250VMMK5	Capacitor polyester 2n2 250V MMK 5mm		Top
	C24	100p200VNP05%5	Capacitor ceramic 100p 200V NP0 5% 5mm		Top
	C25	39p200VNP05%5	Capacitor ceramic 39p 200V NP0 5% 5mm		Top
	C26	270p100VNP05%5	Capacitor ceramic 270p 100V NP0 5% 5mm		Top
	C27	2n2250VMMK5	Capacitor polyester 2n2 250V MMK 5mm		Top
	C28	100p200VNP05%5	Capacitor ceramic 100p 200V NP0 5% 5mm		Top
	C29	39p200VNP05%5	Capacitor ceramic 39p 200V NP0 5% 5mm		Top
	C30	270p100VNP05%5	Capacitor ceramic 270p 100V NP0 5% 5mm		Top
	C31	68p200VNP05%5	Capacitor ceramic 68p 200V NP0 5% 5mm		Top
	C32	1n200VNP05%5	Capacitor ceramic 1n 200V NP0 5% 5mm		Top
	C33	100n63VMMK5	Capacitor polyester 100n 63V MMK 5mm		Top
	C34	100n63VMMK5	Capacitor polyester 100n 63V MMK 5mm		Top
	C35	100n63VMMK5	Capacitor polyester 100n 63V MMK 5mm		Top
	C36	100n63VMMK5	Capacitor polyester 100n 63V MMK 5mm		Top
	C37	10u50V	Capacitor electrolytic 10u 50V 5mm		Top
	C38	1n200VNP05%5	Capacitor ceramic 1n 200V NP0 5% 5mm		Top
	C39	220p200VNP05%5	Capacitor ceramic 220p 200V NP0 5% 5mm		Top
	C40	-	Not used		Top
⚠	C40A	2u2100VMMK15	Capacitor polyester 2u2 100V MMK 15mm		Top
	C41	1n200VNP05%5	Capacitor ceramic 1n 200V NP0 5% 5mm		Top
	C42	100n50VY5W5%5	Capacitor ceramic 100n 50V Y5W 5% 5mm		Bot.
	C43	-	Not used		Top
	C44	1n5200V_MUR	Feed trough capacitor 1n5 200V Murata TF418454E152P		Bot.
	C45	1n5200V_MUR	Feed trough capacitor 1n5 200V Murata TF418454E152P		Bot.

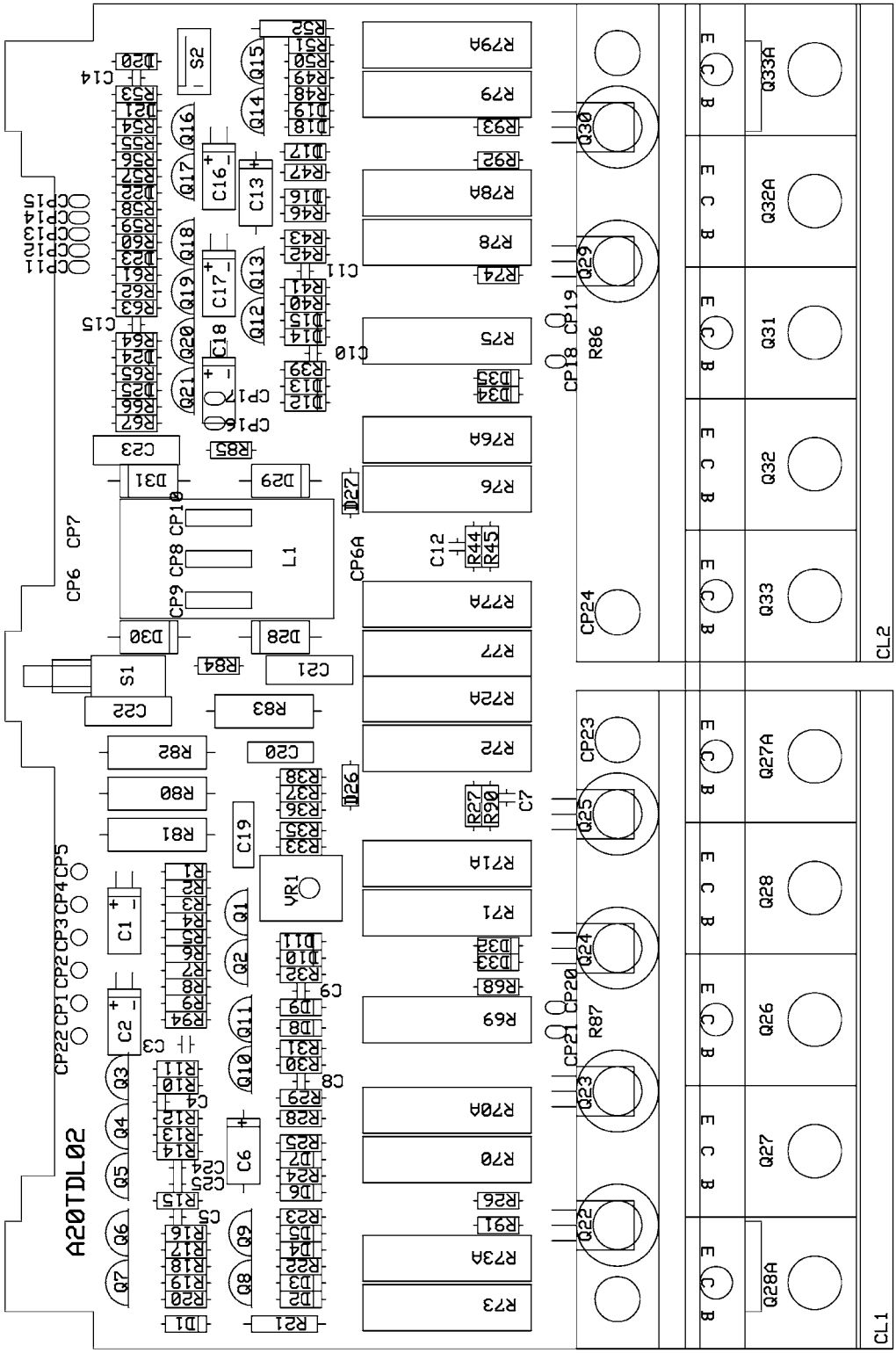
	Position	Partnumber	Description	Comment	Side
	C46	1n5200V_MUR	Feed trough capacitor 1n5 200V Murata TF418454E152P		Bot.
	C47	1n5200V_MUR	Feed trough capacitor 1n5 200V Murata TF418454E152P		Bot.
	C48	1n5200V_MUR	Feed trough capacitor 1n5 200V Murata TF418454E152P		Bot.
	C49	220p200VNP05%5	Capacitor ceramic 220p 200V NP0 5% 5mm		Top
	C50	220p200VNP05%5	Capacitor ceramic 220p 200V NP0 5% 5mm		Top
	C51	1n200VNP05%5	Capacitor ceramic 1n 200V NP0 5% 5mm		Top
	C52	1n200VNP05%5	Capacitor ceramic 1n 200V NP0 5% 5mm		Top
	C53	470p200VNP05%5	Capacitor ceramic 470p 200V NP0 5% 5mm		Top
	C54	470p200VNP05%5	Capacitor ceramic 470p 200V NP0 5% 5mm		Top
	C55	-	Not used		Top
	C56	-	Not used		Top
	D1	-	Not used		Bot.
	D1A	BYW81PI200LY	Diode power BYW81PI200 lying		Bot.
	D1B	BYW81PI200LY	Diode power BYW81PI200 lying		Bot.
	D2	BZW06P15B	Diode transient voltage suppression BZW06P15B		Top
	D3	5V6.4W2%	Diode zener 5V6 .4W 2%		Top
	D4	BYW100-200	Diode power switch BYW100-200		Top
	D5	-	Not used		Bot.
	D5A	BYW81PI200LY	Diode power BYW81PI200 lying		Bot.
	D5B	BYW81PI200LY	Diode power BYW81PI200 lying		Bot.
	D6	BZW06P15B	Diode transient voltage suppression BZW06P15B		Top
	D7	5V6.4W2%	Diode zener 5V6 .4W 2%		Top
	D8	BYW100-200	Diode power switch BYW100-200		Top
	D9	12V.4W5%	Diode zener 12V .4W 5%		Top
	D10	12V.4W5%	Diode zener 12V .4W 5%		Top
	D11	12V.4W5%	Diode zener 12V .4W 5%		Top
	D12	12V.4W5%	Diode zener 12V .4W 5%		Top
	D13	18V1.3W5%	Diode zener 18V 1.3W 5%		Top
	D14	27V.4W5%	Diode zener 27V .4W 5%		Top
	K1	T5WFE20-10-6_LAB	Transformer 5W flyback E20-10-6 LHM core LAB.GRUPPEN Rev 01		Top
	L1	13uHRM14_LAB	Inductor 13uH RM14 LAB.GRUPPEN Rev 01		Top
	L2	u5HD1.18ST_LAB	Inductor u5H Lab.gruppen Rev 01		Top
	L3	u5HD1.18ST_LAB	Inductor u5H Lab.gruppen Rev 01		Top
	L4	13uHRM14_LAB	Inductor 13uH RM14 LAB.GRUPPEN Rev 01		Top
	L5	u5HD1.18ST_LAB	Inductor u5H Lab.gruppen Rev 01		Top
	L6	u5HD1.18ST_LAB	Inductor u5H Lab.gruppen Rev 01		Top
	L7	47uHA6M	Inductor 47uH axial 6 modules		Top
	L8	47uHA6M	Inductor 47uH axial 6 modules		Top
	L9	47uHA6M	Inductor 47uH axial 6 modules		Top
	L10	47uHA6M	Inductor 47uH axial 6 modules		Top
	L11	u5HD1.18ST_LAB	Inductor u5H Lab.gruppen Rev 01		Top
	P1	PH3P90L1M_AMP	Pin header 3pole 90dg locking 1module AMP 640457-3		Top
	Q1	IXFN73N30	Transistor MOS power IXFN73N30		Bot.
	Q2	MTP2955	Transistor MOS power MTP2955		Top
	Q3	BUZ71	Transistor MOS power BUZ71		Top
	Q4	ZTX651STZ	Transistor bipolar signal ZTX651STZ		Top
	Q5	ZTX751STZ	Transistor bipolar signal ZTX751STZ		Top
	Q6	TIP120	Transistor bipolar power TIP120		Top
	Q7	IXFN73N30	Transistor MOS power IXFN73N30		Bot.
	Q8	MTP2955	Transistor MOS power MTP2955		Top
	Q9	BUZ71	Transistor MOS power BUZ71		Top
	Q10	ZTX651STZ	Transistor bipolar signal ZTX651STZ		Top

	Position	Partnumber	Description	Comment	Side
	Q11	ZTX751STZ	Transistor bipolar signal ZTX751STZ		Top
	Q12	TIP120	Transistor bipolar power TIP120		Top
	Q13	IRF730	Transistor MOS power IRF730		Top
	Q14	BC557B	Transistor bipolar signal BC557B		Top
	R2	2R22W5%SO5	Resistor metal film 2R2 2W 5% 5mm stand off		Top
	R3	4R7.25W5%	Resistor Carbon Film 4R7.25W5%		Top
	R4	1R1W5%SO5	Resistor metal film 1R 1W 5% 5mm stand off		Top
	R5	680R.25W5%	Resistor Carbon Film 680R.25W5%		Top
	R6	47R.25W5%	Resistor Carbon Film 47R.25W5%		Top
	R7	2K2.7W1%	Resistor Metal Film 2K2.7W1%		Top
	R8	22K.25W5%	Resistor Carbon Film 22K.25W5%		Top
	R9	820R.25W5%	Resistor Carbon Film 820R.25W5%		Top
	R10	47R.25W5%	Resistor Carbon Film 47R.25W5%		Top
	R11	2K2.7W1%	Resistor Metal Film 2K2.7W1%		Top
	R12	4K7.7W1%	Resistor Metal Film 4K7.7W1%		Top
	R13	15R6W5%SO5	Resistor wirewound 15R 6W 5% 5mm stand off		Top
	R15	2R22W5%SO5	Resistor metal film 2R2 2W 5% 5mm stand off		Top
	R16	4R7.25W5%	Resistor Carbon Film 4R7.25W5%		Top
	R17	1R1W5%SO5	Resistor metal film 1R 1W 5% 5mm stand off		Top
	R18	680R.25W5%	Resistor Carbon Film 680R.25W5%		Top
	R19	47R.25W5%	Resistor Carbon Film 47R.25W5%		Top
	R20	2K2.7W1%	Resistor Metal Film 2K2.7W1%		Top
	R21	22K.25W5%	Resistor Carbon Film 22K.25W5%		Top
	R22	820R.25W5%	Resistor Carbon Film 820R.25W5%		Top
	R23	47R.25W5%	Resistor Carbon Film 47R.25W5%		Top
	R24	1K8.7W1%	Resistor Metal Film 1K8.7W1%		Top
	R25	4K7.7W1%	Resistor Metal Film 4K7.7W1%		Top
	R26	15R6W5%SO5	Resistor wirewound 15R 6W 5% 5mm stand off		Top
	R27	1K5.7W1%	Resistor Metal Film 1K5.7W1%		Top
	R28	1K8.7W1%	Resistor Metal Film 1K8.7W1%		Top
	R29	27K.7W1%	Resistor Metal Film 27K.7W1%		Top
	R30	2K2.7W1%	Resistor Metal Film 2K2.7W1%		Top
	R31	6K8.7W1%	Resistor Metal Film 6K8.7W1%		Top
	R32	4K7.7W1%	Resistor Metal Film 4K7.7W1%		Top
	R33	330R.25W5%	Resistor Carbon Film 330R.25W5%		Top
	R34	1K2.25W5%	Resistor Carbon Film 1K2.25W5%		Top
	R35	56K.7W1%	Resistor Metal Film 56K.7W1%		Top
	R36	1K5.7W1%	Resistor Metal Film 1K5.7W1%		Top
	R37	1K8.7W1%	Resistor Metal Film 1K8.7W1%		Top
	R38	2K2.7W1%	Resistor Metal Film 2K2.7W1%		Top
	R39	27K.7W1%	Resistor Metal Film 27K.7W1%		Top
	R40	6K8.7W1%	Resistor Metal Film 6K8.7W1%		Top
	R41	4K7.7W1%	Resistor Metal Film 4K7.7W1%		Top
	R42	330R.25W5%	Resistor Carbon Film 330R.25W5%		Top
	R43	1K2.25W5%	Resistor Carbon Film 1K2.25W5%		Top
	R44	56K.7W1%	Resistor Metal Film 56K.7W1%		Top
	R45	2K2.7W1%	Resistor Metal Film 2K2.7W1%		Top
	R46	2K2.7W1%	Resistor Metal Film 2K2.7W1%		Top
	R47	1K23W5%SO5	Resistor metal film 1K2 3W 5% 5mm stand off		Top
	R48	12K.25W5%	Resistor Carbon Film 12K.25W5%		Top
	R49	47R.25W5%	Resistor Carbon Film 47R.25W5%		Top
	R50	27R.7W1%SO5	Resistor Metal Film 27R.7W1% 5mm stand off		Top
	R51	1K.7W1%	Resistor Metal Film 1K.7W1%		Top
	R52	1K.7W1%	Resistor Metal Film 1K.7W1%		Top
	R53	2R2.25W5%	Resistor Carbon Film 2R2.25W5%		Top

	Position	Partnumber	Description	Comment	Side
	R54	2R2.25W5%	Resistor Carbon Film 2R2.25W5%		Top
	R55	2K2.7W1%	Resistor Metal Film 2K2.7W1%		Top
	R56	2K2.7W1%	Resistor Metal Film 2K2.7W1%		Top
	R57	1R1W5%SO5	Resistor metal film 1R 1W 5% 5mm stand off		Top
	R58	1R1W5%SO5	Resistor metal film 1R 1W 5% 5mm stand off		Top
	R59	2K2.7W1%	Resistor Metal Film 2K2.7W1%		Top
	R60	2K2.7W1%	Resistor Metal Film 2K2.7W1%		Top
	R61	120K.7W1%	Resistor Metal Film 120K.7W1%		Top
	R62	2R22W5%2MST	Resistor metal film 2R2 2W 5% 2modules standing		Top
	R63	2R22W5%2MST	Resistor metal film 2R2 2W 5% 2modules standing		Top
	R64	2R22W5%2MST	Resistor metal film 2R2 2W 5% 2modules standing		Top
	R65	2R22W5%2MST	Resistor metal film 2R2 2W 5% 2modules standing		Top
	U1	LM318_NAT	IC Operational amplifier LM318 National		Top
	U2	LM318_NAT	IC Operational amplifier LM318 National		Top
	U3	LM319	IC comparator LM319		Top
	U4	HCPL2400	IC photocoupler HCPL2400		Top
	U5	LM393	IC comparator LM393		Top
	U6	HCPL2400	IC photocoupler HCPL2400		Top
	U7	LM393	IC comparator LM393		Top
	U8	UC3843	IC PWM UC3843		Top
	VR1	VR22KLY2X3M	Trimpotentiometer 22K lying 2x3modules		Top
	VR2	VR22KLY2X3M	Trimpotentiometer 22K lying 2x3modules		Top
	VR3	VR1KST2X1M	Trimpotentiometer 1K standing 2x1modules		Top
	VR4	VR10KST2X1M	Trimpotentiometer 10K standing 2x1modules		Top

A20TDL


A20TDL
AMPLIFIER LOW FREQUENCY
2kW CLASS TD
DESIGN K.A
DRAWN K.A
CHECKED
REPLACES 02 04 26
DATE 02 06 25
DRAWING NO A20TDL02
REPLACED BY
PAGE
VHF PROT.
ON
OFF
S2
CLIPLIM.
S1
LF
G
CLIP
NTC
FANSPEED
P
PSUTEMP
GSP
VL
TL
G
O
-LED
LEDBAR
LFC
-LED
-V



DESIGN K.A	DRAWN K.A	CHECKED	A20TDL	REPLACES 02 04 30	REPLACED BY
			AMPLIFIER LOW FREQUENCY 2kW CLASS TD	DATE 02 06 25	PAGE
				DRAWING NO	A20TDL02-P

Component list for A20TDL - rev 02A

⚠ - Safety critical component. Should only be replaced with the specified type.

	Position	Partnumber	Description	Comment	Side
	C1	220u16V	Capacitor electrolytic 220u 16V 5mm		Top
	C2	10u50V	Capacitor electrolytic 10u 50V 5mm		Top
	C3	150p500VK20005%5	Capacitor ceramic 150p 500V K2000 5% 5mm		Top
	C4	-	Not used		Top
	C5	680p400VK20005%5	Capacitor ceramic 680p 400V K2000 5% 5mm		Top
	C6	1u100V5x10A	Capacitor electrolytic 1u 100V 5x10mm axial		Top
	C7	1n250VMMK5	Capacitor polyester 1n 250V MMK 5mm		Top
	C8	1n250VMMK5	Capacitor polyester 1n 250V MMK 5mm		Top
	C9	680p400VK20005%5	Capacitor ceramic 680p 400V K2000 5% 5mm		Top
	C10	680p400VK20005%5	Capacitor ceramic 680p 400V K2000 5% 5mm		Top
	C11	1n250VMMK5	Capacitor polyester 1n 250V MMK 5mm		Top
	C12	1n250VMMK5	Capacitor polyester 1n 250V MMK 5mm		Top
	C13	1u100V5x10A	Capacitor electrolytic 1u 100V 5x10mm axial		Top
	C14	39p200VNP05%5	Capacitor ceramic 39p 200V NP0 5% 5mm		Top
	C15	100n63VMMK5	Capacitor polyester 100n 63V MMK 5mm		Top
	C16	220u16V	Capacitor electrolytic 220u 16V 5mm		Top
	C17	4u750V	Capacitor electrolytic 4u7 50V 5mm		Top
	C18	10u50V	Capacitor electrolytic 10u 50V 5mm		Top
	C19	22n250VMMK7.5	Capacitor polyester 22n 250V MMK 7.5mm		Top
	C20	47n250VMMK7.5	Capacitor polyester 47n 250V MMK 7.5mm		Top
	C21	100n250VMMK10	Capacitor polyester 100n 250V MMK 10mm		Top
	C22	100n250VMMK10	Capacitor polyester 100n 250V MMK 10mm		Top
	C23	100n250VMMK10	Capacitor polyester 100n 250V MMK 10mm		Top
	C24	6n8250VMMK5	Capacitor polyester 6n8 250V MMK 5mm	May have different value	Top
	C25	6n8250VMMK5	Capacitor polyester 6n8 250V MMK 5mm	May have different value	Top
	D1	15V.4W5%	Diode zener 15V .4W 5%		Top
	D2	1N4148	Diode signal 1N4148		Top
	D3	1N4148	Diode signal 1N4148		Top
	D4	1N4148	Diode signal 1N4148		Top
	D5	1N4148	Diode signal 1N4148		Top
	D6	1N4004	Diode power 1N4004		Top
	D7	27V.4W5%	Diode zener 27V .4W 5%		Top
	D8	BAV21	Diode signal BAV21		Top
	D9	1N4148	Diode signal 1N4148		Top
	D10	1N4148	Diode signal 1N4148		Top
	D11	BAV21	Diode signal BAV21		Top
	D12	BAV21	Diode signal BAV21		Top
	D13	1N4148	Diode signal 1N4148		Top
	D14	1N4148	Diode signal 1N4148		Top
	D15	BAV21	Diode signal BAV21		Top
	D16	27V.4W5%	Diode zener 27V .4W 5%		Top
	D17	1N4004	Diode power 1N4004		Top
	D18	1N4148	Diode signal 1N4148		Top
	D19	1N4148	Diode signal 1N4148		Top
	D20	15V.4W5%	Diode zener 15V .4W 5%		Top
	D21	1N4004	Diode power 1N4004		Top
	D22	1N4148	Diode signal 1N4148		Top
	D23	1N4148	Diode signal 1N4148		Top
	D24	1N4148	Diode signal 1N4148		Top
	D25	1N4148	Diode signal 1N4148		Top

	Position	Partnumber	Description	Comment	Side
	D26	1N4004	Diode power 1N4004		Top
	D27	1N4004	Diode power 1N4004		Top
	D28	BYW96E	Diode power switch BYW96E		Top
	D29	BYW96E	Diode power switch BYW96E		Top
	D30	1N5404	Diode power 1N5404		Top
	D31	1N5404	Diode power 1N5404		Top
	D32	100V1.3W5%	Diode zener 100V 1.3W 5%		Top
	D33	100V1.3W5%	Diode zener 100V 1.3W 5%		Top
	D34	100V1.3W5%	Diode zener 100V 1.3W 5%		Top
	D35	100V1.3W5%	Diode zener 100V 1.3W 5%		Top
	L1	-	Not used		Top
	Q1	BC549C	Transistor bipolar signal BC549C		Top
	Q2	BC549C	Transistor bipolar signal BC549C		Top
	Q3	BC547B	Transistor bipolar signal BC547B		Top
	Q4	BC557B	Transistor bipolar signal BC557B		Top
	Q5	BC557B	Transistor bipolar signal BC557B		Top
	Q6	MPSA42	Transistor bipolar signal MPSA42		Top
	Q7	MPSA42	Transistor bipolar signal MPSA42		Top
	Q8	BC557B	Transistor bipolar signal BC557B		Top
	Q9	BC557B	Transistor bipolar signal BC557B		Top
	Q10	BC547B	Transistor bipolar signal BC547B		Top
	Q11	BC557B	Transistor bipolar signal BC557B		Top
	Q12	BC547B	Transistor bipolar signal BC547B		Top
	Q13	BC557B	Transistor bipolar signal BC557B		Top
	Q14	BC547B	Transistor bipolar signal BC547B		Top
	Q15	BC547B	Transistor bipolar signal BC547B		Top
	Q16	BC547B	Transistor bipolar signal BC547B		Top
	Q17	BC547B	Transistor bipolar signal BC547B		Top
	Q18	BC557B	Transistor bipolar signal BC557B		Top
	Q19	BC557B	Transistor bipolar signal BC557B		Top
	Q20	BC547B	Transistor bipolar signal BC547B		Top
	Q21	BC547B	Transistor bipolar signal BC547B		Top
	Q22	MJE350LY	Transistor bipolar power MJE350 lying		Top
	Q23	MJE350LY	Transistor bipolar power MJE350 lying		Top
	Q24	MJE340LY	Transistor bipolar power MJE340 lying		Top
	Q25	BD329LY	Transistor bipolar power BD329 lying		Top
	Q26	MJL21194_SA	Transistor bipolar power MJL21194 surface mounted	May have different value	Bot.
	Q27		Variant dependent, see separate list	May have different value	Bot.
	Q27A	MJL21194_SA	Transistor bipolar power MJL21194 surface mounted	May have different value	Bot.
	Q28	MJL21194_SA	Transistor bipolar power MJL21194 surface mounted	May have different value	Bot.
	Q28A	MJL21194_SA	Transistor bipolar power MJL21194 surface mounted	May have different value	Bot.
	Q29	MJE350LY	Transistor bipolar power MJE350 lying		Top
	Q30	MJE340LY	Transistor bipolar power MJE340 lying		Top
	Q31	MJL21193_SA	Transistor bipolar power MJL21193 surface mounted	May have different value	Bot.
	Q32	MJL21193_SA	Transistor bipolar power MJL21193 surface mounted	May have different value	Bot.
	Q32A	MJL21193_SA	Transistor bipolar power MJL21193 surface mounted	May have different value	Bot.
	Q33	MJL21193_SA	Transistor bipolar power MJL21193 surface mounted	May have different value	Bot.

	Position	Partnumber	Description	Comment	Side
	Q33A		Variant dependent, see separate list	May have different value	Bot.
	R1	10R.25W5%	Resistor Carbon Film 10R.25W5%		Top
	R2	27K.7W1%	Resistor Metal Film 27K.7W1%		Top
	R3		Variant dependent, see separate list		Top
	R4	180R.7W1%	Resistor Metal Film 180R.7W1%		Top
	R5	1K8.7W1%	Resistor Metal Film 1K8.7W1%		Top
	R6	180R.7W1%	Resistor Metal Film 180R.7W1%		Top
	R7	27K.7W1%	Resistor Metal Film 27K.7W1%		Top
	R8	10R.25W5%	Resistor Carbon Film 10R.25W5%		Top
	R9	1K.7W1%	Resistor Metal Film 1K.7W1%		Top
	R10	100K.7W1%	Resistor Metal Film 100K.7W1%		Top
	R11	1K8.7W1%	Resistor Metal Film 1K8.7W1%		Top
	R12	27K.7W1%	Resistor Metal Film 27K.7W1%		Top
	R13	27K.7W1%	Resistor Metal Film 27K.7W1%		Top
	R14	3K3.7W1%	Resistor Metal Film 3K3.7W1%		Top
	R15	3K3.7W1%	Resistor Metal Film 3K3.7W1%		Top
	R16	4K7.7W1%	Resistor Metal Film 4K7.7W1%		Top
	R17	3K3.7W1%	Resistor Metal Film 3K3.7W1%		Top
	R18	3K3.7W1%	Resistor Metal Film 3K3.7W1%		Top
	R19	100K.7W1%	Resistor Metal Film 100K.7W1%		Top
	R20	100K.7W1%	Resistor Metal Film 100K.7W1%		Top
	R21	18K2W5%SO5	Resistor metal film 18K 2W 5% 5mm stand off		Top
	R22	100R.7W1%	Resistor Metal Film 100R.7W1%		Top
	R23	100R.7W1%	Resistor Metal Film 100R.7W1%		Top
	R24		Variant dependent, see separate list		Top
	R25	68K.7W1%	Resistor Metal Film 68K.7W1%		Top
	R26		Variant dependent, see separate list		Top
	R27	12K4.7W1%	Resistor Metal Film 12K4.7W1%		Top
	R28	3K9.7W1%	Resistor Metal Film 3K9.7W1%		Top
	R29	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R30	4K7.7W1%	Resistor Metal Film 4K7.7W1%		Top
	R31	560K.7W1%	Resistor Metal Film 560K.7W1%		Top
	R32	220R.25W5%	Resistor Carbon Film 220R.25W5%		Top
	R33	3K3.7W1%	Resistor Metal Film 3K3.7W1%		Top
	R35	604R.7W1%	Resistor Metal Film 604R.7W1%		Top
	R36	100K.7W1%	Resistor Metal Film 100K.7W1%		Top
	R37	100K.7W1%	Resistor Metal Film 100K.7W1%		Top
	R38	820K.25W5%	Resistor Carbon Film 820K.25W5%		Top
	R39	220R.25W5%	Resistor Carbon Film 220R.25W5%		Top
	R40	560K.7W1%	Resistor Metal Film 560K.7W1%		Top
	R41	4K7.7W1%	Resistor Metal Film 4K7.7W1%		Top
	R42	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R43	3K9.7W1%	Resistor Metal Film 3K9.7W1%		Top
	R44	12K4.7W1%	Resistor Metal Film 12K4.7W1%		Top
	R45	12K4.7W1%	Resistor Metal Film 12K4.7W1%		Top
	R46	68K.7W1%	Resistor Metal Film 68K.7W1%		Top
	R47		Variant dependent, see separate list		Top
	R48	100R.7W1%	Resistor Metal Film 100R.7W1%		Top
	R49	100R.7W1%	Resistor Metal Film 100R.7W1%		Top
	R50	100K.7W1%	Resistor Metal Film 100K.7W1%		Top
	R51	100K.7W1%	Resistor Metal Film 100K.7W1%		Top
	R52	18K2W5%SO5	Resistor metal film 18K 2W 5% 5mm stand off		Top
	R53	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R54	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R55	220K.7W1%	Resistor Metal Film 220K.7W1%		Top

	Position	Partnumber	Description	Comment	Side
	R56	100K.7W1%	Resistor Metal Film 100K.7W1%		Top
	R57	220K.7W1%	Resistor Metal Film 220K.7W1%		Top
	R58	56K.7W1%	Resistor Metal Film 56K.7W1%		Top
	R59	56K.7W1%	Resistor Metal Film 56K.7W1%		Top
	R60	27K.7W1%	Resistor Metal Film 27K.7W1%		Top
	R61	3K3.7W1%	Resistor Metal Film 3K3.7W1%		Top
	R62	432K.7W1%	Resistor Metal Film 432K.7W1%		Top
	R63	2M2.25W5%	Resistor Carbon Film 2M2.25W5%		Top
	R64	27K.7W1%	Resistor Metal Film 27K.7W1%		Top
	R65	2K7.7W1%	Resistor Metal Film 2K7.7W1%		Top
	R66	100K.7W1%	Resistor Metal Film 100K.7W1%		Top
	R67	56K.7W1%	Resistor Metal Film 56K.7W1%		Top
	R68	47R.25W5%	Resistor Carbon Film 47R.25W5%		Top
	R69	4R75W5%	Resistor wirewound 4R7 5W 5%		Top
	R70		Variant dependent, see separate list		Top
	R70A		Variant dependent, see separate list		Top
	R71		Variant dependent, see separate list		Top
	R71A		Variant dependent, see separate list		Top
	R72		Variant dependent, see separate list		Top
	R72A		Variant dependent, see separate list		Top
	R73		Variant dependent, see separate list		Top
	R73A		Variant dependent, see separate list		Top
	R74	47R.25W5%	Resistor Carbon Film 47R.25W5%		Top
	R75	4R75W5%	Resistor wirewound 4R7 5W 5%		Top
	R76		Variant dependent, see separate list		Top
	R76A		Variant dependent, see separate list		Top
	R77		Variant dependent, see separate list		Top
	R77A		Variant dependent, see separate list		Top
	R78		Variant dependent, see separate list		Top
	R78A		Variant dependent, see separate list		Top
	R79		Variant dependent, see separate list		Top
	R79A		Variant dependent, see separate list		Top
	R80	6K83W5%SO5	Resistor metal film 6K8 3W 5% 5mm stand off		Top
	R81	820R6W5%SO5	Resistor wirewound 820R 6W 5% 5mm stand off		Top
	R82	1K53W5%SO5	Resistor metal film 1K5 3W 5% 5mm stand off		Top
	R83	10R3W5%SO5	Resistor metal film 10R 3W 5% 5mm stand off		Top
	R84	10R.25W5%SO5	Resistor Carbon Film 10R.25W5% 5mm stand off		Top
	R85	10R.25W5%SO5	Resistor Carbon Film 10R.25W5% 5mm stand off		Top
	R86	NTC150KM3_EPC	Resistor NTC 150K M3 EPCOS B57045-K154-K		Top
	R87	NTC150KM3_EPC	Resistor NTC 150K M3 EPCOS B57045-K154-K		Top
	R90	12K4.7W1%	Resistor Metal Film 12K4.7W1%		Top
	R91	12K4.7W1%	Resistor Metal Film 12K4.7W1%		Top
	R92		Variant dependent, see separate list		Top
	R93	12K4.7W1%	Resistor Metal Film 12K4.7W1%		Top
	R94	27K.7W1%	Resistor Metal Film 27K.7W1%		Top
	S1	SPPJ32F29A_ALP	Switch inter locking PCB DPDT ALPS SPPJ32F29A		Top
	S2	R03M.6	Resistor jumper 0R 3modules D.6mm		Top
	VR1	VR220RLY2X3M	Trimpotentiometer 220R lying 2x3modules		Top

Variant specific components

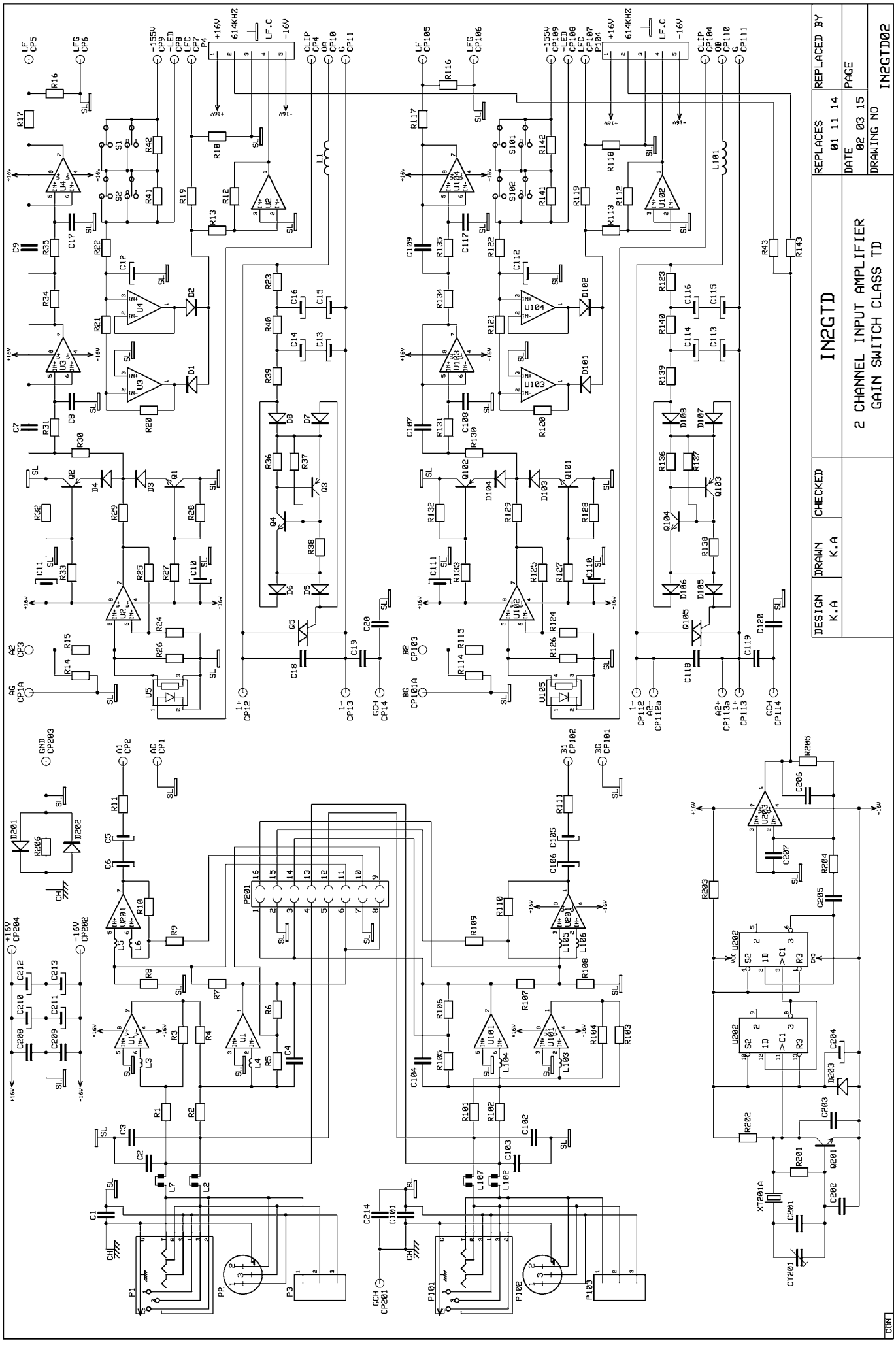
	Position	A20TDL-17-2	A20TDL-32-2
	Q27	-	MJL21194_SA
	Q33A	-	MJL21193_SA

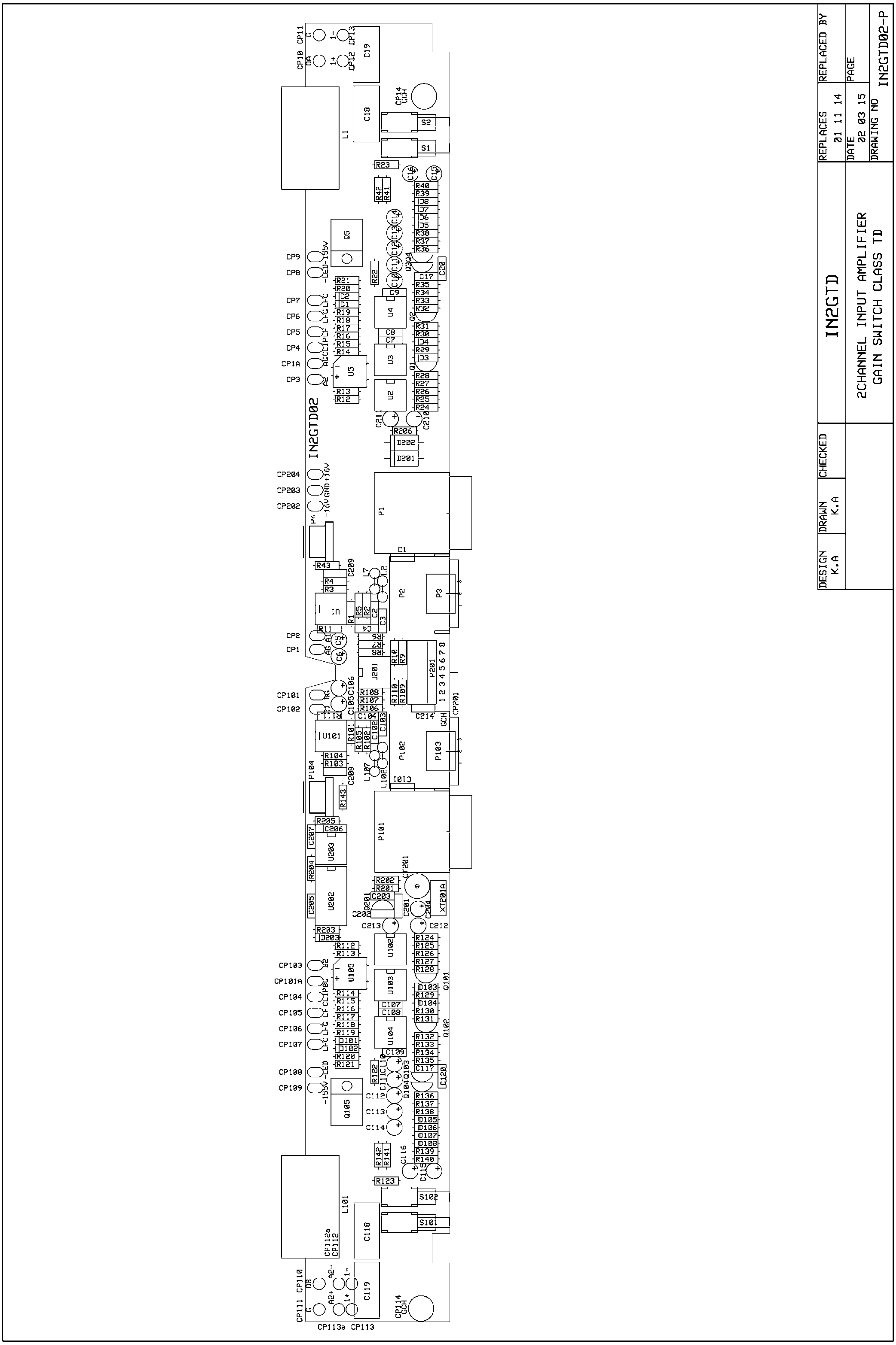
	Position	A20TDL-17-2	A20TDL-32-2
	R3	1K.7W1%	806R.7W1%
	R24	27K.7W1%	56K.7W1%
	R26	-	12K4.7W1%
	R47	27K.7W1%	56K.7W1%
	R70	-	R335W10%
	R70A	-	R335W10%
	R71	R275W10%	R335W10%
	R71A	R275W10%	R335W10%
	R72	R275W10%	R335W10%
	R72A	R275W10%	R335W10%
	R73	R275W10%	R335W10%
	R73A	R275W10%	R335W10%
	R76	R275W10%	R335W10%
	R76A	R275W10%	R335W10%
	R77	R275W10%	R335W10%
	R77A	R275W10%	R335W10%
	R78	-	R335W10%
	R78A	-	R335W10%
	R79	R275W10%	R335W10%
	R79A	R275W10%	R335W10%
	R92	-	12K4.7W1%

Description for variant dependent components

Partnumber	Description
12K4.7W1%	Resistor Metal Film 12K4.7W1%
1K.7W1%	Resistor Metal Film 1K.7W1%
27K.7W1%	Resistor Metal Film 27K.7W1%
56K.7W1%	Resistor Metal Film 56K.7W1%
806R.7W1%	Resistor Metal Film 806R.7W1%
MJL21193_SA	Transistor bipolar power MJL21193 surface mounted
MJL21194_SA	Transistor bipolar power MJL21194 surface mounted
R275W10%	Resistor wirewound R27 5W 10%
R335W10%	Resistor wirewound R33 5W 10%

IN2GTD


IN2GTD
2 CHANNEL INPUT AMPLIFIER
GAIN SWITCH CLASS TD
DESIGN K.A
DRAWN K.A
CHECKED
REPLACES 01 11 14
DATE 02 03 15
PAGE
DRAWING NO IN2GTD02
REPLACED BY


IN2GTD
2CHANNEL INPUT AMPLIFIER
GAIN SWITCH CLASS TD
REPLACES
01 11 14
REPLACED BY
DATE
02 03 15
PAGE
DRAWING NO
IN2GTD02-P
DESIGN
K.A
DRAWN
K.A
CHECKED
IN2GTD02

Component list for IN2GTD - rev 02A

⚠ - Safety critical component. Should only be replaced with the specified type.

	Position	Partnumber	Description	Comment	Side
	C1	100n63VMMK5	Capacitor polyester 100n 63V MMK 5mm		Top
	C2	22p200VNP05%5	Capacitor ceramic 22p 200V NP0 5% 5mm		Top
	C3	22p200VNP05%5	Capacitor ceramic 22p 200V NP0 5% 5mm		Top
	C4	22p200VNP05%5	Capacitor ceramic 22p 200V NP0 5% 5mm		Top
	C5	22u50V	Capacitor electrolytic 22u 50V 5mm		Top
	C6	22u50V	Capacitor electrolytic 22u 50V 5mm		Top
	C7	220p200VNP05%5	Capacitor ceramic 220p 200V NP0 5% 5mm		Top
	C8	220p200VNP05%5	Capacitor ceramic 220p 200V NP0 5% 5mm		Top
	C9	330p200VNP05%5	Capacitor ceramic 330p 200V NP0 5% 5mm		Top
	C10	10u50V	Capacitor electrolytic 10u 50V 5mm		Top
	C11	10u50V	Capacitor electrolytic 10u 50V 5mm		Top
	C12	u4750V	Capacitor electrolytic u47 50V 5mm		Top
	C13	22u50V	Capacitor electrolytic 22u 50V 5mm		Top
	C14	22u50V	Capacitor electrolytic 22u 50V 5mm		Top
	C15	22u50V	Capacitor electrolytic 22u 50V 5mm		Top
	C16	22u50V	Capacitor electrolytic 22u 50V 5mm		Top
	C17	100p200VNP05%5	Capacitor ceramic 100p 200V NP0 5% 5mm		Top
	C18	470n250VMMK15	Capacitor polyester 470n 250V MMK 15mm		Top
	C19	2u2100VMMK15	Capacitor polyester 2u2 100V MMK 15mm		Top
	C20	100n50VY5W5%5	Capacitor ceramic 100n 50V Y5W 5% 5mm		Top
	C101	100n63VMMK5	Capacitor polyester 100n 63V MMK 5mm		Top
	C102	22p200VNP05%5	Capacitor ceramic 22p 200V NP0 5% 5mm		Top
	C103	22p200VNP05%5	Capacitor ceramic 22p 200V NP0 5% 5mm		Top
	C104	22p200VNP05%5	Capacitor ceramic 22p 200V NP0 5% 5mm		Top
	C105	22u50V	Capacitor electrolytic 22u 50V 5mm		Top
	C106	22u50V	Capacitor electrolytic 22u 50V 5mm		Top
	C107	220p200VNP05%5	Capacitor ceramic 220p 200V NP0 5% 5mm		Top
	C108	220p200VNP05%5	Capacitor ceramic 220p 200V NP0 5% 5mm		Top
	C109	330p200VNP05%5	Capacitor ceramic 330p 200V NP0 5% 5mm		Top
	C110	10u50V	Capacitor electrolytic 10u 50V 5mm		Top
	C111	10u50V	Capacitor electrolytic 10u 50V 5mm		Top
	C112	u4750V	Capacitor electrolytic u47 50V 5mm		Top
	C113	22u50V	Capacitor electrolytic 22u 50V 5mm		Top
	C114	22u50V	Capacitor electrolytic 22u 50V 5mm		Top
	C115	22u50V	Capacitor electrolytic 22u 50V 5mm		Top
	C116	22u50V	Capacitor electrolytic 22u 50V 5mm		Top
	C117	100p200VNP05%5	Capacitor ceramic 100p 200V NP0 5% 5mm		Top
	C118	470n250VMMK15	Capacitor polyester 470n 250V MMK 15mm		Top
	C119	2u2100VMMK15	Capacitor polyester 2u2 100V MMK 15mm		Top
	C120	100n50VY5W5%5	Capacitor ceramic 100n 50V Y5W 5% 5mm		Top
	C201	22p200VNP05%5	Capacitor ceramic 22p 200V NP0 5% 5mm		Top
	C202	220p200VNP05%5	Capacitor ceramic 220p 200V NP0 5% 5mm		Top
	C203	68p200VNP05%5	Capacitor ceramic 68p 200V NP0 5% 5mm		Top
	C204	10u50V	Capacitor electrolytic 10u 50V 5mm		Top
	C205	1n250VMMK5	Capacitor polyester 1n 250V MMK 5mm		Top
	C206	68p200VNP05%5	Capacitor ceramic 68p 200V NP0 5% 5mm		Top
	C207	22p200VNP05%5	Capacitor ceramic 22p 200V NP0 5% 5mm		Top
	C208	10n250VMMK5	Capacitor polyester 10n 250V MMK 5mm		Top
	C209	10n250VMMK5	Capacitor polyester 10n 250V MMK 5mm		Top
	C210	22u50V	Capacitor electrolytic 22u 50V 5mm		Top
	C211	22u50V	Capacitor electrolytic 22u 50V 5mm		Top
	C212	22u50V	Capacitor electrolytic 22u 50V 5mm		Top

	Position	Partnumber	Description	Comment	Side
	C213	22u50V	Capacitor electrolytic 22u 50V 5mm		Top
	C214	100n50VY5W5%5	Capacitor ceramic 100n 50V Y5W 5% 5mm		Top
	CT201	VC3-50P_BC	Capacitor trim 3-50p BC components 222280811509		Top
	D1	1N4148	Diode signal 1N4148		Top
	D2	1N4148	Diode signal 1N4148		Top
	D3	1N4148	Diode signal 1N4148		Top
	D4	1N4148	Diode signal 1N4148		Top
	D5	1N4148	Diode signal 1N4148		Top
	D6	1N4148	Diode signal 1N4148		Top
	D7	1N4148	Diode signal 1N4148		Top
	D8	1N4148	Diode signal 1N4148		Top
	D101	1N4148	Diode signal 1N4148		Top
	D102	1N4148	Diode signal 1N4148		Top
	D103	1N4148	Diode signal 1N4148		Top
	D104	1N4148	Diode signal 1N4148		Top
	D105	1N4148	Diode signal 1N4148		Top
	D106	1N4148	Diode signal 1N4148		Top
	D107	1N4148	Diode signal 1N4148		Top
	D108	1N4148	Diode signal 1N4148		Top
	D201	1N5404	Diode power 1N5404		Top
	D202	1N5404	Diode power 1N5404		Top
	D203	5V6.4W2%	Diode zener 5V6 .4W 2%		Top
	L1	8uHD1.8_LAB	Inductor 8uH axial LAB. Rev 01		Top
	L2	L2xBEAD2M	Inductor bead double 2 modules		Top
	L7	L2xBEAD2M	Inductor bead double 2 modules		Top
	L101	8uHD1.8_LAB	Inductor 8uH axial LAB. Rev 01		Top
	L102	L2xBEAD2M	Inductor bead double 2 modules		Top
	L107	L2xBEAD2M	Inductor bead double 2 modules		Top
	P1	NCJ6FI-H_NEU	Connector XLR/J 3pole female+jack 90dg NEUTRIK NCJ6FI-H		Top
	P2	NC3MA-H_NEU	Connector XLR 3pole male 90dg NEUTRIK NC3MA-H		Top
	P3	-	Not used		Top
	P4	PH5P90L1M_AMP	Pin header 5pole 90dg locking 1module AMP 640457-5		Top
	P101	NCJ6FI-H_NEU	Connector XLR/J 3pole female+jack 90dg NEUTRIK NCJ6FI-H		Top
	P102	NC3MA-H_NEU	Connector XLR 3pole male 90dg NEUTRIK NC3MA-H		Top
	P103	-	Not used		Top
	P104	PH5P90L1M_AMP	Pin header 5pole 90dg locking 1module AMP 640457-5		Top
	P201	DI16P901M_PRE	Dil socket 16pole 90dg 1 module PRECI-DIP 299-93-316-11-001		Top
	Q1	BC547B	Transistor bipolar signal BC547B		Top
	Q2	BC557B	Transistor bipolar signal BC557B		Top
	Q3	BC557B	Transistor bipolar signal BC557B		Top
	Q4	BC547B	Transistor bipolar signal BC547B		Top
	Q5	Q6015L5LY	Triac Q6015L5 lying		Top
	Q101	BC547B	Transistor bipolar signal BC547B		Top
	Q102	BC557B	Transistor bipolar signal BC557B		Top
	Q103	BC557B	Transistor bipolar signal BC557B		Top
	Q104	BC547B	Transistor bipolar signal BC547B		Top
	Q105	Q6015L5LY	Triac Q6015L5 lying		Top
	Q201	BC547B	Transistor bipolar signal BC547B		Top
	R1	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R2	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R3	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R4	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R5	3K3.7W1%	Resistor Metal Film 3K3.7W1%		Top
	R6	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R7	2K.7W1%	Resistor Metal Film 2K.7W1%		Top

	Position	Partnumber	Description	Comment	Side
	R8	4K7.7W1%	Resistor Metal Film 4K7.7W1%		Top
	R9	4K7.7W1%	Resistor Metal Film 4K7.7W1%		Top
	R10	4K7.7W1%	Resistor Metal Film 4K7.7W1%		Top
	R11	47R.25W5%	Resistor Carbon Film 47R.25W5%		Top
	R12	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R13	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R14	4K7.7W1%	Resistor Metal Film 4K7.7W1%		Top
	R15	18K.7W1%	Resistor Metal Film 18K.7W1%		Top
	R16	5K36.7W1%	Resistor Metal Film 5K36.7W1%		Top
	R17	4K7.7W1%	Resistor Metal Film 4K7.7W1%		Top
	R18	12K4.7W1%	Resistor Metal Film 12K4.7W1%		Top
	R19	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R20	47K.7W1%	Resistor Metal Film 47K.7W1%		Top
	R21	47K.7W1%	Resistor Metal Film 47K.7W1%		Top
	R22	715K.7W1%	Resistor Metal Film 715K.7W1%		Top
	R23	27K.7W1%	Resistor Metal Film 27K.7W1%		Top
	R24		Variant dependent, see separate list		Top
	R25	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R26	12K.7W1%	Resistor Metal Film 12K.7W1%		Top
	R27	18K.7W1%	Resistor Metal Film 18K.7W1%		Top
	R28	47K.7W1%	Resistor Metal Film 47K.7W1%		Top
	R29	1K.7W1%	Resistor Metal Film 1K.7W1%		Top
	R30	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R31	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R32	47K.7W1%	Resistor Metal Film 47K.7W1%		Top
	R33	18K.7W1%	Resistor Metal Film 18K.7W1%		Top
	R34	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R35	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R36	22K.7W1%	Resistor Metal Film 22K.7W1%		Top
	R37	390K.7W1%	Resistor Metal Film 390K.7W1%		Top
	R38	22K.7W1%	Resistor Metal Film 22K.7W1%		Top
	R39	47R.25W5%	Resistor Carbon Film 47R.25W5%		Top
	R40	27K.7W1%	Resistor Metal Film 27K.7W1%		Top
	R41		Variant dependent, see separate list		Top
	R42	2K4.7W1%SO5	Resistor Metal Film 2K4.7W1% 5mm stand off		Top
	R43	100R.7W1%	Resistor Metal Film 100R.7W1%		Top
	R101	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R102	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R103	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R104	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R105	3K3.7W1%	Resistor Metal Film 3K3.7W1%		Top
	R106	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R107	2K.7W1%	Resistor Metal Film 2K.7W1%		Top
	R108	4K7.7W1%	Resistor Metal Film 4K7.7W1%		Top
	R109	4K7.7W1%	Resistor Metal Film 4K7.7W1%		Top
	R110	4K7.7W1%	Resistor Metal Film 4K7.7W1%		Top
	R111	47R.25W5%	Resistor Carbon Film 47R.25W5%		Top
	R112	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R113	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R114	4K7.7W1%	Resistor Metal Film 4K7.7W1%		Top
	R115	18K.7W1%	Resistor Metal Film 18K.7W1%		Top
	R116	5K36.7W1%	Resistor Metal Film 5K36.7W1%		Top
	R117	4K7.7W1%	Resistor Metal Film 4K7.7W1%		Top
	R118	12K4.7W1%	Resistor Metal Film 12K4.7W1%		Top
	R119	10K.7W1%	Resistor Metal Film 10K.7W1%		Top

	Position	Partnumber	Description	Comment	Side
	R120	47K.7W1%	Resistor Metal Film 47K.7W1%		Top
	R121	47K.7W1%	Resistor Metal Film 47K.7W1%		Top
	R122	715K.7W1%	Resistor Metal Film 715K.7W1%		Top
	R123	27K.7W1%	Resistor Metal Film 27K.7W1%		Top
	R124		Variant dependent, see separate list		Top
	R125	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R126	12K.7W1%	Resistor Metal Film 12K.7W1%		Top
	R127	18K.7W1%	Resistor Metal Film 18K.7W1%		Top
	R128	47K.7W1%	Resistor Metal Film 47K.7W1%		Top
	R129	1K.7W1%	Resistor Metal Film 1K.7W1%		Top
	R130	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R131	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R132	47K.7W1%	Resistor Metal Film 47K.7W1%		Top
	R133	18K.7W1%	Resistor Metal Film 18K.7W1%		Top
	R134	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R135	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R136	22K.7W1%	Resistor Metal Film 22K.7W1%		Top
	R137	390K.7W1%	Resistor Metal Film 390K.7W1%		Top
	R138	22K.7W1%	Resistor Metal Film 22K.7W1%		Top
	R139	47R.25W5%	Resistor Carbon Film 47R.25W5%		Top
	R140	27K.7W1%	Resistor Metal Film 27K.7W1%		Top
	R141		Variant dependent, see separate list		Top
	R142	2K4.7W1%SO5	Resistor Metal Film 2K4.7W1% 5mm stand off		Top
	R143	100R.7W1%	Resistor Metal Film 100R.7W1%		Top
	R201	220K.7W1%	Resistor Metal Film 220K.7W1%		Top
	R202	1K.7W1%	Resistor Metal Film 1K.7W1%		Top
	R203	2K2.7W1%	Resistor Metal Film 2K2.7W1%		Top
	R204	2K2.7W1%	Resistor Metal Film 2K2.7W1%		Top
	R205	22K.7W1%	Resistor Metal Film 22K.7W1%		Top
	R206	10R.25W5%	Resistor Carbon Film 10R.25W5%		Top
	S1	SPPJ32F29A_ALP	Switch inter locking PCB DPDT ALPS SPPJ32F29A		Top
	S2	SPPJ32F29A_ALP	Switch inter locking PCB DPDT ALPS SPPJ32F29A		Top
	S101	SPPJ32F29A_ALP	Switch inter locking PCB DPDT ALPS SPPJ32F29A		Top
	S102	SPPJ32F29A_ALP	Switch inter locking PCB DPDT ALPS SPPJ32F29A		Top
	U1	MC33078	IC Operational amplifier MC33078		Top
	U2	NE5532	IC Operational amplifier NE5532		Top
	U3	LF353	IC Operational amplifier LF353		Top
	U4	LF353	IC Operational amplifier LF353		Top
	U5	VTL5C4	IC photocoupler VTL5C4		Top
	U101	MC33078	IC Operational amplifier MC33078		Top
	U102	NE5532	IC Operational amplifier NE5532		Top
	U103	LF353	IC Operational amplifier LF353		Top
	U104	LF353	IC Operational amplifier LF353		Top
	U105	VTL5C4	IC photocoupler VTL5C4		Top
	U201	NE5532	IC Operational amplifier NE5532		Top
	U202	74HC74	IC logic 74HC74		Top
	U203	LM318_NAT	IC Operational amplifier LM318 National		Top
	XT201A	HC49-2.4576M	Crystal HC49 2.4576MHz		Top

Variant specific components

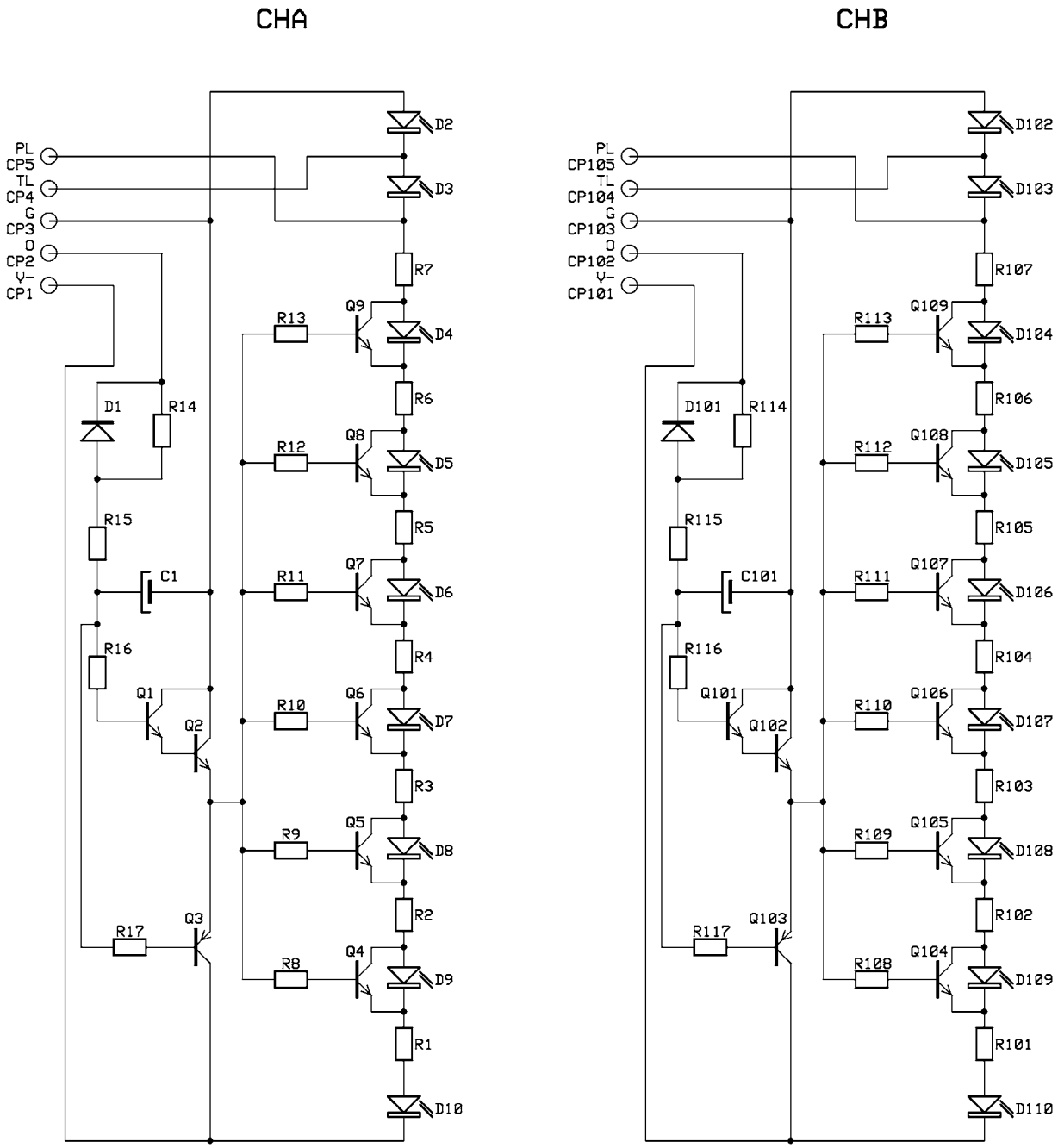
	Position	IN2GTD-2x17-2	IN2GTD-2x32-2
	R24	1K24.7W1%	1K54.7W1%
	R41	6K21W5%SO5	4K71W5%SO5

	Position	IN2GTD-2x17-2	IN2GTD-2x32-2
	R124	1K24.7W1%	1K54.7W1%
	R141	6K21W5%SO5	4K71W5%SO5

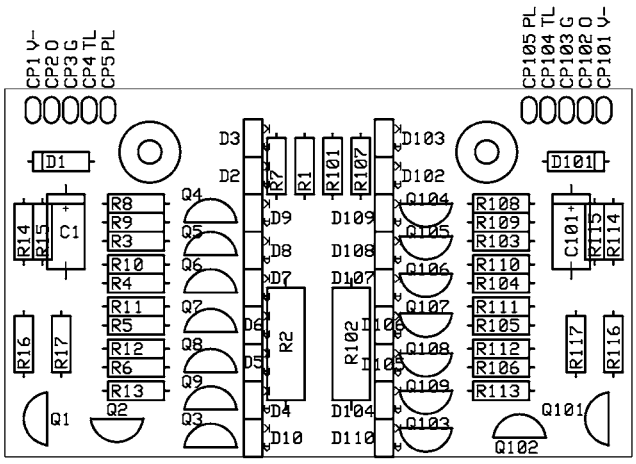
Description for variant dependent components

Partnumber	Description
1K24.7W1%	Resistor Metal Film 1K24.7W1%
1K54.7W1%	Resistor Metal Film 1K54.7W1%
4K71W5%SO5	Resistor metal film 4K7 1W 5% 5mm stand off
6K21W5%SO5	Resistor metal film 6K2 1W 5% 5mm stand off

LD92



CON					
DESIGN K.A	DRAWN K.A	CHECKED	LD92	REPLACES 01 03 03	REPLACED BY
			LED DISPLAY 9xLED 2 CHANNEL	DATE 02 04 15	PAGE
				DRAWING NO LD9201	



DESIGN	DRAWN	CHECKED		REPLACES	REPLACED BY
K.A	K.A		LD92	01 03 03	
			LED DISPLAY	DATE 02 04 15	PAGE
			9xLED 2 CHANNEL	DRAWING NO	LD9201-P

Component list for LD92 - rev 01

⚠ - Safety critical component. Should only be replaced with the specified type.

	Position	Partnumber	Description	Comment	Side
	C1		Variant dependent, see separate list		Top
	C101		Variant dependent, see separate list		Top
	D1	1N4004	Diode power 1N4004		Top
	D2	LYEL2.5x5	Diode LED Yellow 2.5x5mm		Top
	D3	LYEL2.5x5	Diode LED Yellow 2.5x5mm		Top
	D4	LGRN2.5x5	Diode LED Green 2.5x5mm		Top
	D5	LGRN2.5x5	Diode LED Green 2.5x5mm		Top
	D6	LGRN2.5x5	Diode LED Green 2.5x5mm		Top
	D7	LGRN2.5x5	Diode LED Green 2.5x5mm		Top
	D8	LGRN2.5x5	Diode LED Green 2.5x5mm		Top
	D9	LRED2.5x5	Diode LED Red 2.5x5mm		Top
	D10	LGRN2.5x5	Diode LED Green 2.5x5mm		Top
	D101	1N4004	Diode power 1N4004		Top
	D102	LYEL2.5x5	Diode LED Yellow 2.5x5mm		Top
	D103	LYEL2.5x5	Diode LED Yellow 2.5x5mm		Top
	D104	LGRN2.5x5	Diode LED Green 2.5x5mm		Top
	D105	LGRN2.5x5	Diode LED Green 2.5x5mm		Top
	D106	LGRN2.5x5	Diode LED Green 2.5x5mm		Top
	D107	LGRN2.5x5	Diode LED Green 2.5x5mm		Top
	D108	LGRN2.5x5	Diode LED Green 2.5x5mm		Top
	D109	LRED2.5x5	Diode LED Red 2.5x5mm		Top
	D110	LGRN2.5x5	Diode LED Green 2.5x5mm		Top
	Q1	MPSA42	Transistor bipolar signal MPSA42		Top
	Q2	MPSA42	Transistor bipolar signal MPSA42		Top
	Q3	MPSA92	Transistor bipolar signal MPSA92		Top
	Q4	BC547B	Transistor bipolar signal BC547B		Top
	Q5	BC547B	Transistor bipolar signal BC547B		Top
	Q6	BC547B	Transistor bipolar signal BC547B		Top
	Q7	BC547B	Transistor bipolar signal BC547B		Top
	Q8	BC547B	Transistor bipolar signal BC547B		Top
	Q9	BC547B	Transistor bipolar signal BC547B		Top
	Q101	MPSA42	Transistor bipolar signal MPSA42		Top
	Q102	MPSA42	Transistor bipolar signal MPSA42		Top
	Q103	MPSA92	Transistor bipolar signal MPSA92		Top
	Q104	BC547B	Transistor bipolar signal BC547B		Top
	Q105	BC547B	Transistor bipolar signal BC547B		Top
	Q106	BC547B	Transistor bipolar signal BC547B		Top
	Q107	BC547B	Transistor bipolar signal BC547B		Top
	Q108	BC547B	Transistor bipolar signal BC547B		Top
	Q109	BC547B	Transistor bipolar signal BC547B		Top
	R1		Variant dependent, see separate list		Top
	R2		Variant dependent, see separate list		Top
	R3		Variant dependent, see separate list		Top
	R4		Variant dependent, see separate list		Top
	R5		Variant dependent, see separate list		Top
	R6		Variant dependent, see separate list		Top
	R7		Variant dependent, see separate list		Top
	R8		Variant dependent, see separate list		Top
	R9		Variant dependent, see separate list		Top
	R10		Variant dependent, see separate list		Top
	R11		Variant dependent, see separate list		Top
	R12		Variant dependent, see separate list		Top

	Position	Partnumber	Description	Comment	Side
	R13		Variant dependent, see separate list		Top
	R14		Variant dependent, see separate list		Top
	R15		Variant dependent, see separate list		Top
	R16	2K7.25W5%	Resistor Carbon Film 2K7.25W5%		Top
	R17	2K7.25W5%	Resistor Carbon Film 2K7.25W5%		Top
	R101		Variant dependent, see separate list		Top
	R102		Variant dependent, see separate list		Top
	R103		Variant dependent, see separate list		Top
	R104		Variant dependent, see separate list		Top
	R105		Variant dependent, see separate list		Top
	R106		Variant dependent, see separate list		Top
	R107		Variant dependent, see separate list		Top
	R108		Variant dependent, see separate list		Top
	R109		Variant dependent, see separate list		Top
	R110		Variant dependent, see separate list		Top
	R111		Variant dependent, see separate list		Top
	R112		Variant dependent, see separate list		Top
	R113		Variant dependent, see separate list		Top
	R114		Variant dependent, see separate list		Top
	R115		Variant dependent, see separate list		Top
	R116	2K7.25W5%	Resistor Carbon Film 2K7.25W5%		Top
	R117	2K7.25W5%	Resistor Carbon Film 2K7.25W5%		Top

Variant specific components

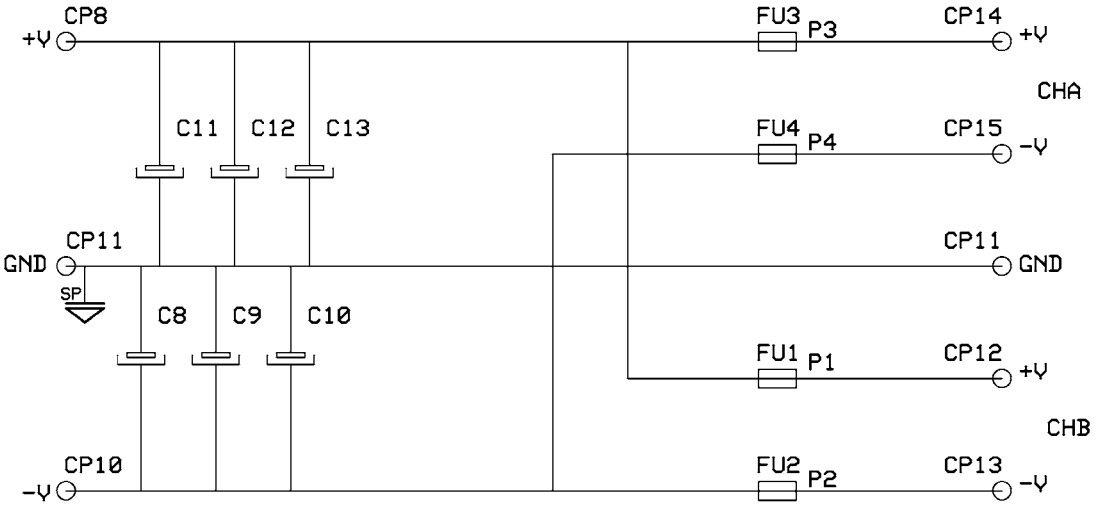
	Position	LD92-2x13-2	LD92-2x32-2
	C1	4u7100V5x10A	2u2250V6.5x18A
	C101	4u7100V5x10A	2u2250V6.5x18A
	R1	680R.25W5%	1K2.7W1%SO5
	R2	2K73W5%	4K73W5%
	R3	1K21W5%	2K2.7W1%
	R4	680R.25W5%	1K2.7W1%
	R5	330R.25W5%	560R.25W5%
	R6	120R.25W5%	220R.25W5%
	R7	220R.25W5%	390R.25W5%
	R8	33K.25W5%	56K.25W5%
	R9	33K.25W5%	56K.25W5%
	R10	33K.25W5%	56K.25W5%
	R11	33K.25W5%	56K.25W5%
	R12	33K.25W5%	56K.25W5%
	R13	33K.25W5%	56K.25W5%
	R14	33K.25W5%	56K.25W5%
	R15	100R.7W1%	220R.25W5%
	R101	680R.25W5%	1K2.7W1%SO5
	R102	2K73W5%	4K73W5%
	R103	1K21W5%	2K2.7W1%
	R104	680R.25W5%	1K2.7W1%
	R105	330R.25W5%	560R.25W5%
	R106	120R.25W5%	220R.25W5%
	R107	220R.25W5%	390R.25W5%
	R108	33K.25W5%	56K.25W5%
	R109	33K.25W5%	56K.25W5%

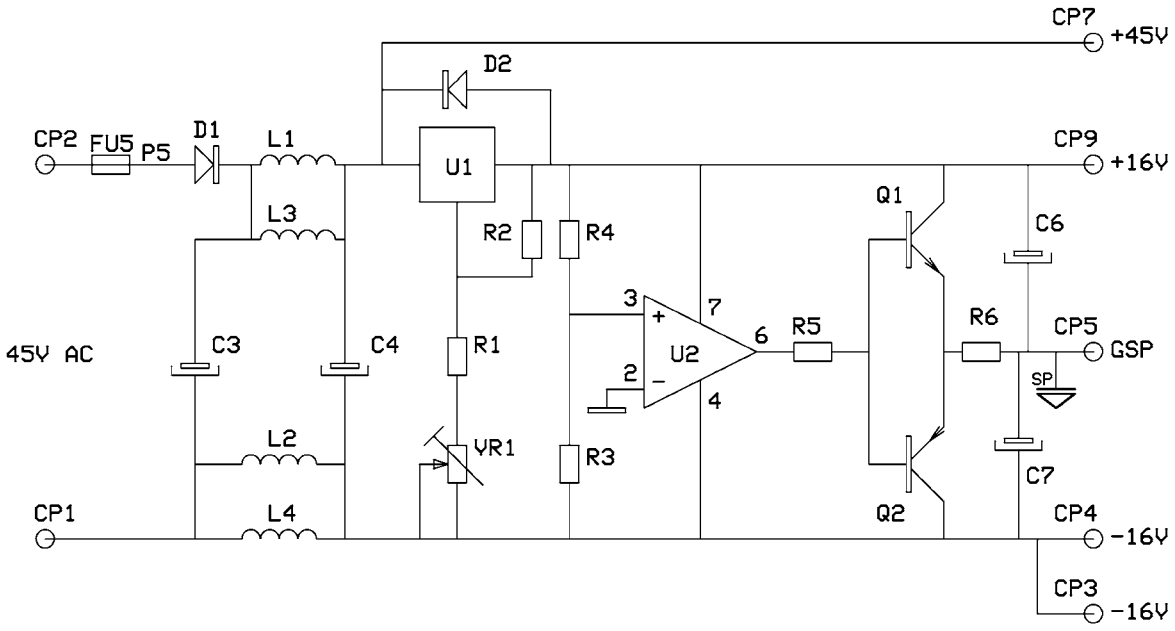
	Position	LD92-2x13-2	LD92-2x32-2
	R110	33K.25W5%	56K.25W5%
	R111	33K.25W5%	56K.25W5%
	R112	33K.25W5%	56K.25W5%
	R113	33K.25W5%	56K.25W5%
	R114	33K.25W5%	56K.25W5%
	R115	100R.7W1%	220R.25W5%

Description for variant dependent components

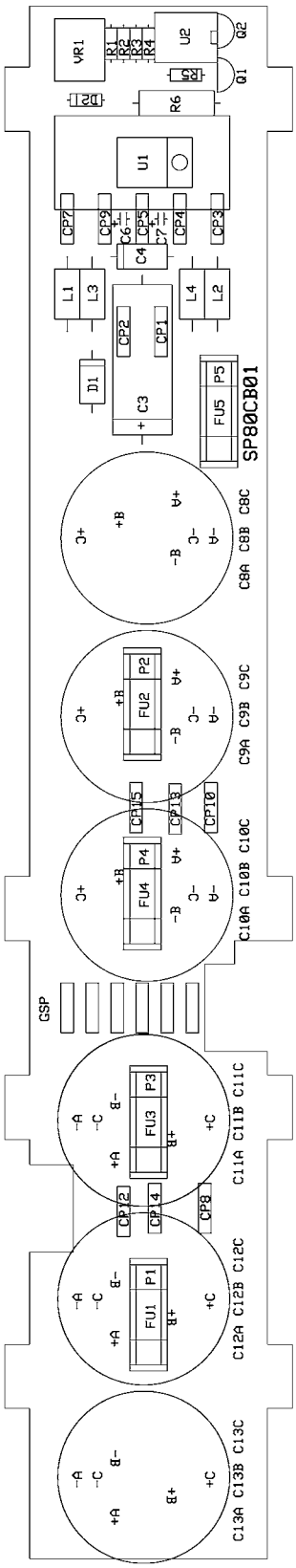
Partnumber	Description
100R.7W1%	Resistor Metal Film 100R.7W1%
120R.25W5%	Resistor Carbon Film 120R.25W5%
1K2.7W1%	Resistor Metal Film 1K2.7W1%
1K2.7W1%SO5	Resistor Metal Film 1K2.7W1% 5mm stand off
1K21W5%	Resistor metal film 1K2 1W 5%
220R.25W5%	Resistor Carbon Film 220R.25W5%
2K2.7W1%	Resistor Metal Film 2K2.7W1%
2K73W5%	Resistor metal film 2K7 3W 5%
2u2250V6.5x18A	Capacitor electrolytic 2u2 250V 6.5x18mm axial
330R.25W5%	Resistor Carbon Film 330R.25W5%
33K.25W5%	Resistor Carbon Film 33K.25W5%
390R.25W5%	Resistor Carbon Film 390R.25W5%
4K73W5%	Resistor metal film 4K7 3W 5%
4u7100V5x10A	Capacitor electrolytic 4u7 100V 5x10mm axial
560R.25W5%	Resistor Carbon Film 560R.25W5%
56K.25W5%	Resistor Carbon Film 56K.25W5%
680R.25W5%	Resistor Carbon Film 680R.25W5%

SP80CB





CON					
DESIGN K.A	DRAWN K.A	CHECKED	SP80CB	REPLACES 96 08 01	REPLACED BY
			SWITCH MODE POWERSUPPLY 8kW CAPACITOR BANK	DATE 02 04 26	PAGE
				DRAWING NO	SP80CB01



DESIGN K.A	DRAWN K.A	CHECKED	SP80CB	REPLACES 01 05 04	REPLACED BY
			SWITCH MODE POWERSUPPLY 8kW CAPACITOR BANK	DATE 02 04 30	PAGE
				DRAWING NO	SP80CB01-P

Component list for SP80CB-2x32-2 - rev 01A

⚠ - Safety critical component. Should only be replaced with the specified type.

	Position	Partnumber	Description	Comment	Side
	C3	470u100V18x30A	Capacitor electrolytic 470u 100V 18x30mm axial		Top
	C4	22u100V8x18A	Capacitor electrolytic 22u 100V 8x18mm axial		Top
	C6	22u50V	Capacitor electrolytic 22u 50V 5mm		Top
	C7	22u50V	Capacitor electrolytic 22u 50V 5mm		Top
	C8	2200u160V35x45	Capacitor electrolytic 2200u 160V 35x45mm snap in		Top
	C9	2200u160V35x45	Capacitor electrolytic 2200u 160V 35x45mm snap in		Top
	C10	2200u160V35x45	Capacitor electrolytic 2200u 160V 35x45mm snap in		Top
	C11	2200u160V35x45	Capacitor electrolytic 2200u 160V 35x45mm snap in		Top
	C12	2200u160V35x45	Capacitor electrolytic 2200u 160V 35x45mm snap in		Top
	C13	2200u160V35x45	Capacitor electrolytic 2200u 160V 35x45mm snap in		Top
	D1	BYW98-200	Diode power switch BYW98-200		Top
	D2	1N4004	Diode power 1N4004		Top
⚠	FU1	T15A250-5x20	Fuse slow blow 15A 250V 5x20mm		Bot.
⚠	FU2	T15A250-5x20	Fuse slow blow 15A 250V 5x20mm		Bot.
⚠	FU3	T15A250-5x20	Fuse slow blow 15A 250V 5x20mm		Bot.
⚠	FU4	T15A250-5x20	Fuse slow blow 15A 250V 5x20mm		Bot.
⚠	FU5	T2A5250-5x20	Fuse slow blow 2.5A 250V 5x20mm		Top
	L1	47uHA6M	Inductor 47uH axial 6 modules		Top
	L2	47uHA6M	Inductor 47uH axial 6 modules		Top
	L3	47uHA6M	Inductor 47uH axial 6 modules		Top
	L4	47uHA6M	Inductor 47uH axial 6 modules		Top
	P1	FBPC5x209M	Fuseblock PCB 5x20mm fuse 9 modules		Bot.
	P2	FBPC5x209M	Fuseblock PCB 5x20mm fuse 9 modules		Bot.
	P3	FBPC5x209M	Fuseblock PCB 5x20mm fuse 9 modules		Bot.
	P4	FBPC5x209M	Fuseblock PCB 5x20mm fuse 9 modules		Bot.
	P5	FBPC5x209M	Fuseblock PCB 5x20mm fuse 9 modules		Top
	Q1	BC337	Transistor bipolar signal BC337		Top
	Q2	BC327	Transistor bipolar signal BC327		Top
	R1	5K6.25W5%	Resistor Carbon Film 5K6.25W5%		Top
	R2	270R.25W5%	Resistor Carbon Film 270R.25W5%		Top
	R3	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R4	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R5	1K.25W5%	Resistor Carbon Film 1K.25W5%		Top
	R6	150R3W5%SO5	Resistor metal film 150R 3W 5% 5mm stand off		Top
	U1	LM317TLY	IC voltage regulator LM317T lying		Top
	U2	UA741	IC Operational amplifier UA741		Top
	VR1	VR2K2LY2X3M	Trimpotentiometer 2K2 lying 2x3modules		Top

SP80FA / SP80FB

Functional description for switch mode powersupply SP80FA & SP80FB

Theory of function

SP80FA-board:
AC-power is coming in to terminal P1, passing interference filter L1, L2 and then reaching RE1 and R5.

In some variants the on-off switch is located directly after terminal P1, in other variants it is connected to CP5-CP7, controlling the soft start relay RE1. When the on-off switch turns in position CP5-CP6, soft start resistor R5 gives power to mains rectifier D1.

The voltage is rectified by D1 and filtered by C8, C9 and C1, C2 (SP80FB). This gives 310V DC to the transformer.

SP80FB-board:
Current generator R17, D4, Q5, R16, R10 charge C9 until D3 conduct at 15V. Q8 work as under voltage protection for the +15V voltage by turning U1:3 to 5V if U1:15 drops below 14V.

When U1:2 (under voltage protect) reach 3V soft start capacitor C10 (U1:8) is released, witch slowly increase the pulse width of U1:12.

The PWM-controller U1:12 controls the switch Q1-Q3 to give the correct output voltage at terminal CP17, CP19 (SP80FA). When the switch Q1-Q3 is closed, current flows trough transformer, storing energy. Because of the voltage polarity, diode D3, D4 (SP80FA) are reverse-biased, thus no voltage present at the load. When the switch is open, the transformer reverses polarity because of the collapsing magnetic field, forward-biasing diode D3, D4 and inducing a current flow into the capacitors C12, C14 (SP80FA).

If U1:3 (over voltage protect) goes above 3V the pulses on pin 12 stops immediately. This occurs if the main voltage is too high, or the voltage across snubber capacitor C5 is too high.

The reversed voltage is sensed by a winding in the transformer and rectified by diode D8. The PWM-controller adjust the on-time of the switch, by comparing the voltage across C14 (U1:17) with an internal reference (U1:16), to give the right rail voltage across the capacitors C12, C14 (SP80FA). The voltage can be adjusted by potentiometer VR2.

The maximum current in the transformer is sensed over the resistor R6-R8. The voltage across R6-R8 is compared (U1:6) with a reference-voltage, set by VR3, witch make it possible to adjust the maximum output power from the power supply. Normally VR3 is in maximum position, but if something has to be repaired in the amplifier, VR3 is used for "slow starting" the amplifier.

SP80FA-board:
Immediately when Q1-Q3 (SP80FB) turn on, D2 rectify the pulse from the transformer (CP11, CP12). The DC voltage across C7 activates RE1 witch short soft start resistor R5.

To turn off the amplifier the on-off switch is set in position CP6-CP7. This disconnects R5, and open RE1, turning the amplifier off.

Repairing instructions

REQUIRED MEASUREMENT EQUIPMENT:
-Audio generator
-Dummy load, 16 ohm
-Digital voltmeter
-Variac 0-280V, 6A
-50Mhz oscilloscope, ex. Tek 2225 with 100x probe ex. Tek P6009
-Isolation transformer for the mains, 1:1

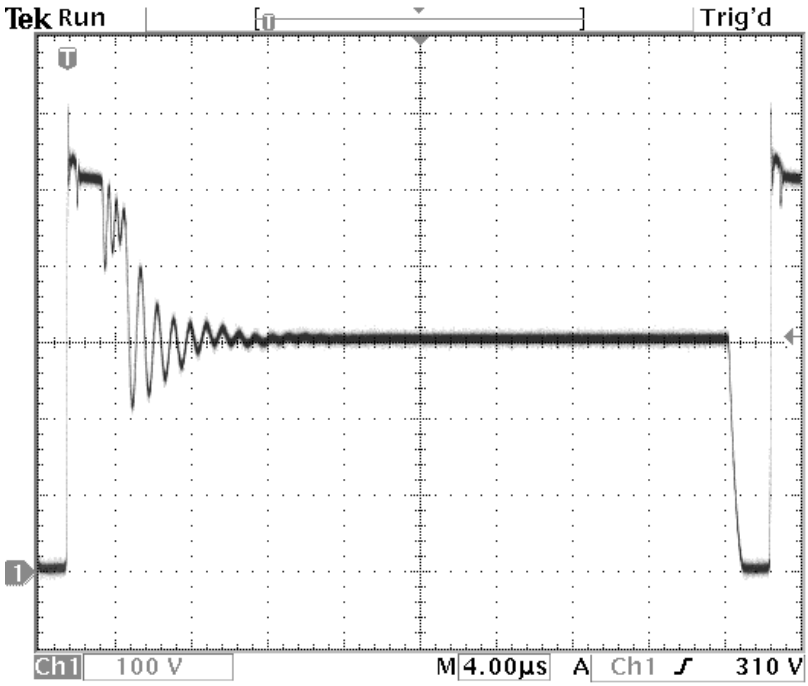
1) Turn VR3 (SP80FB) fully counter clockwise.
2) Change FU1 (SP80FA).
3) Increase the main voltage slowly by the variac.
4) Measure the voltage across C8 and C9 (SP80FA).
   a) No voltage: -change R5 (SP80FA).
   b) The current increases quickly:
      -check D1 (SP80FA).

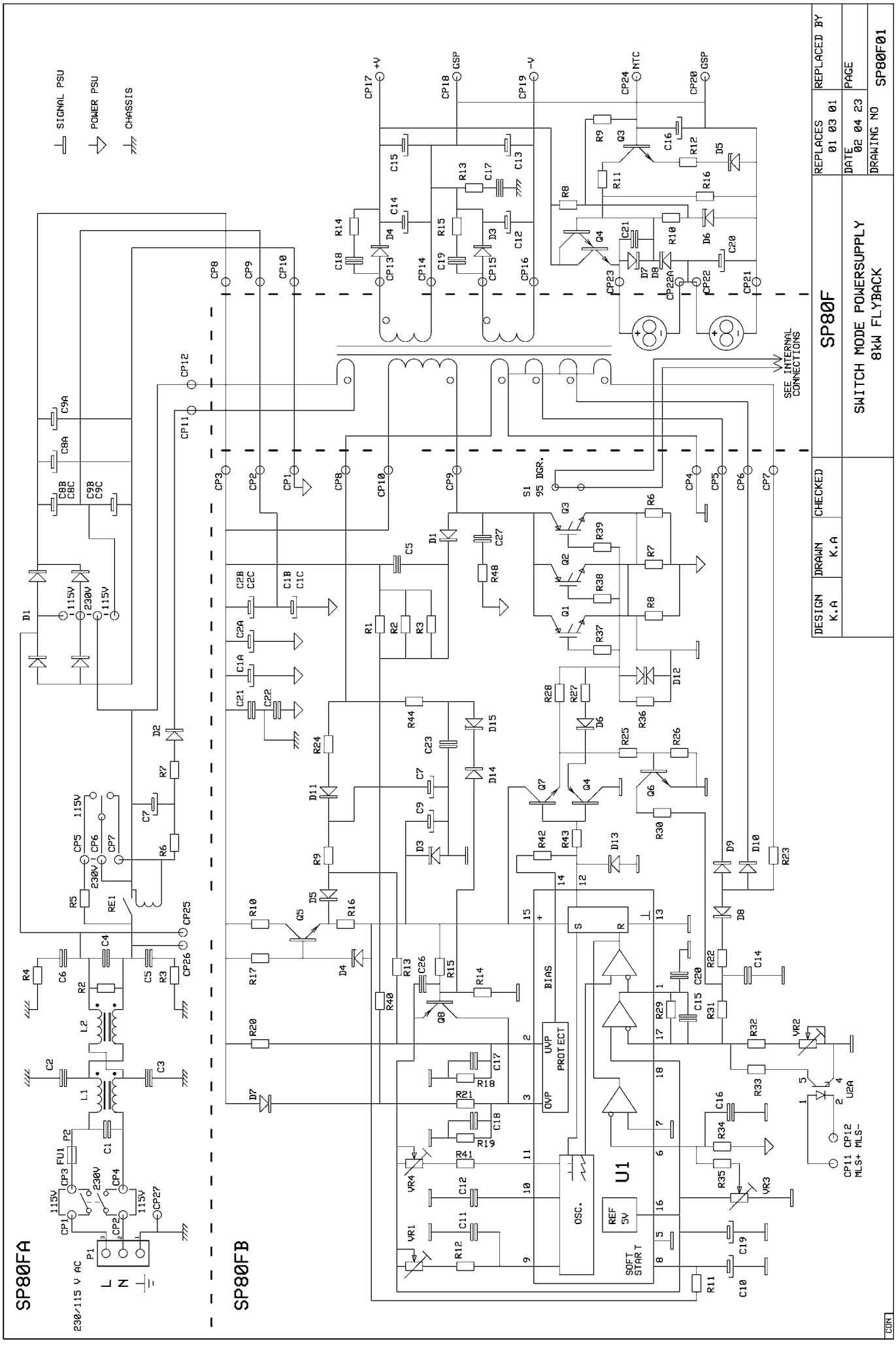
-check Q1, Q2, Q3 (SP80FB).

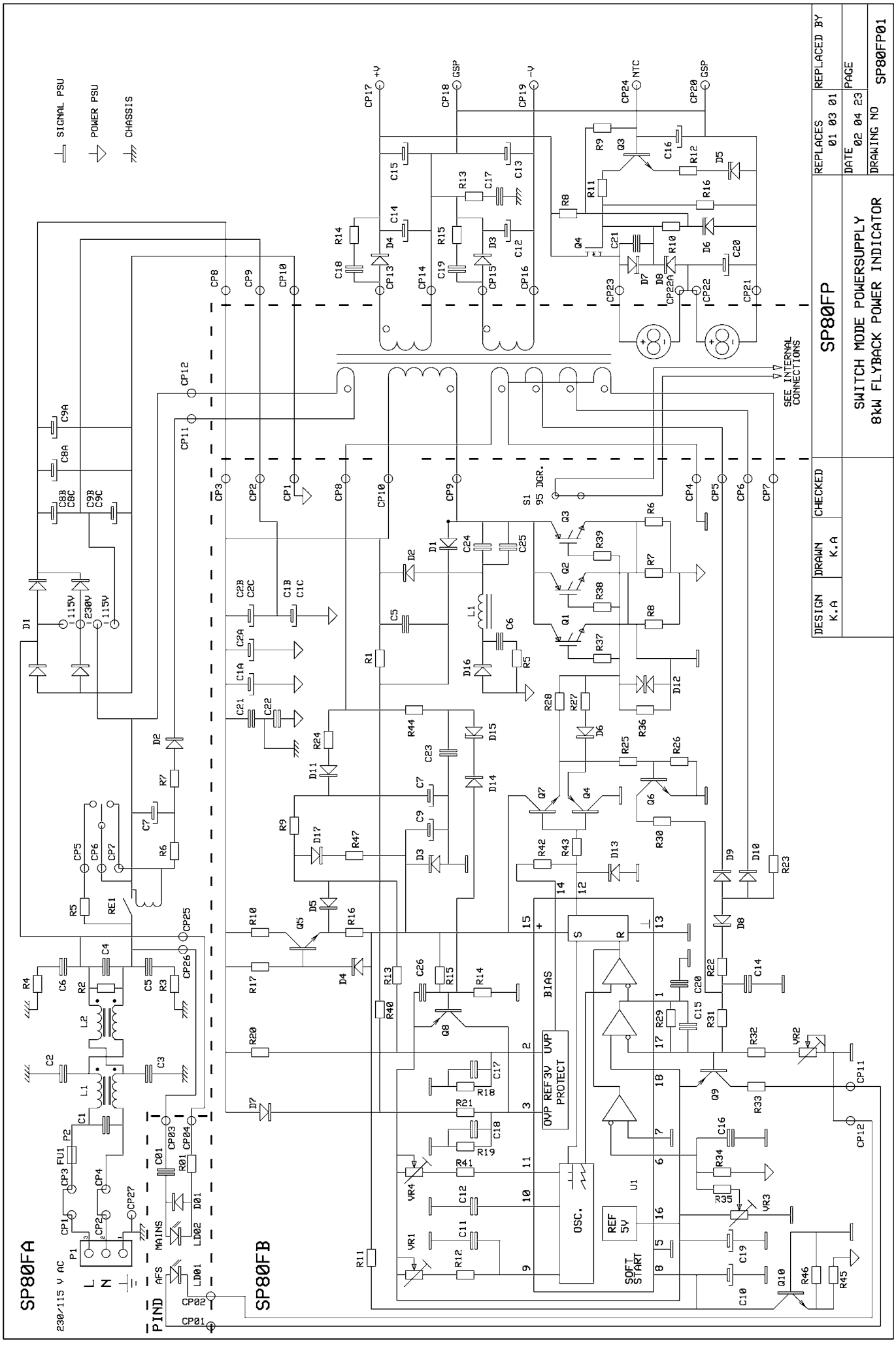
It is now possible to increase the voltage across C8 and C9 (SP80FA) to approx. 300V without current inrush.
Measure across Q1 (SP80FB) collector and emitter with an oscilloscope. This oscilloscope should be connected to mains power with an isolation transformer.

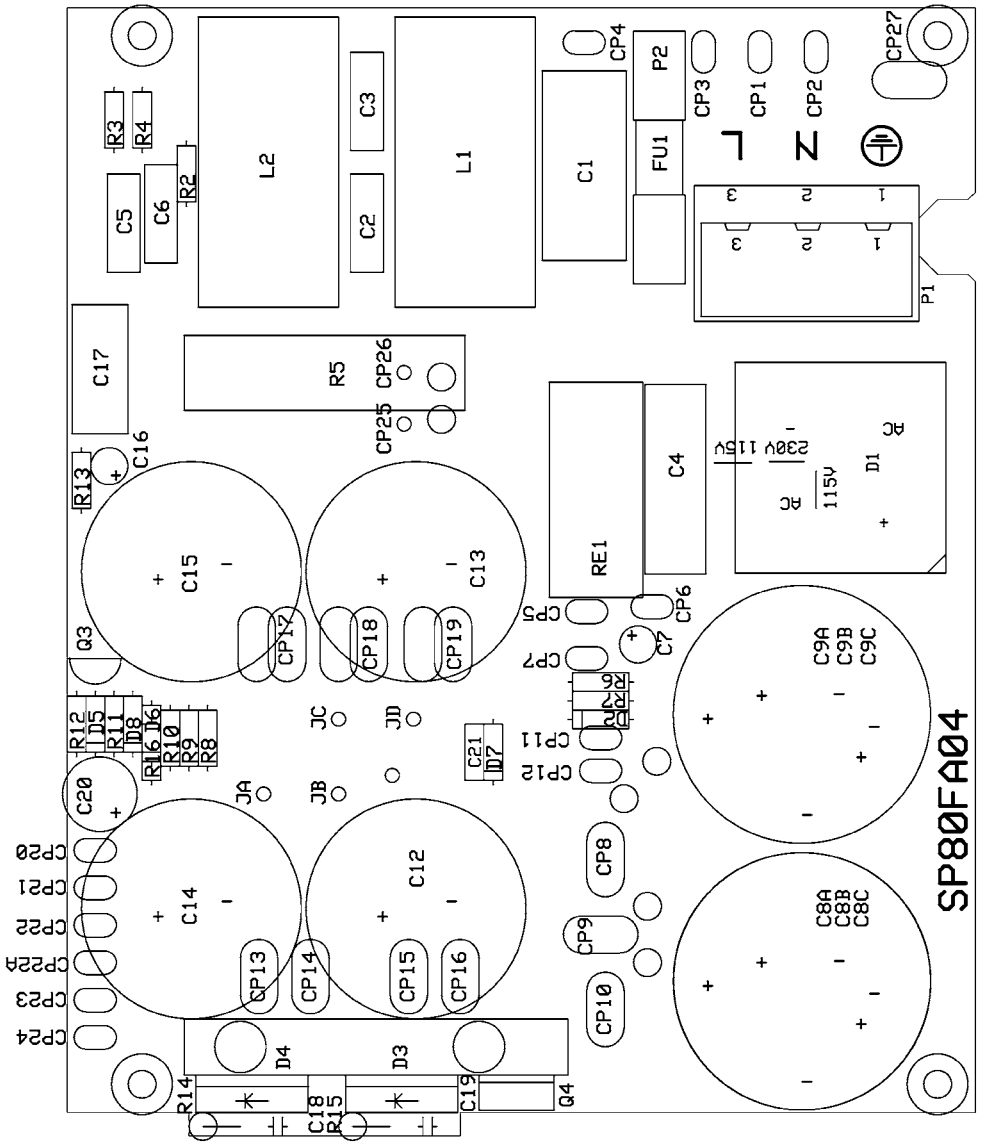
7) Turn VR3 slowly clockwise until a pulse is visible on the scope. The frequency is approx. 27 kHz (see figure1). If the graph is seen, go to item 9).
8) If only narrow spikes is seen, check the following components.
   a) D3, D4 (SP80FA) or the output circuits.
   b) D1, C5, R1 (SP80FA) -makes U1 go into over voltage protection.
   c) U1 -the output will remain low all the time.
9) Turn VR3 fully clockwise:
   a) Check the output voltage on C12, C14 (SP80FA). Adjust with VR2.
   b) Check the soft start circuit by turning the main switch on and off and look at the oscilloscope.
   c) Increase the power by applying an audio signal to the amplifier and turn up the gain controls. -The pulse width will increase.
   d) Check the over/ under voltage protection circuits by turning the variac up to 280 VAC and down to 130 VAC. (No load)

Fig. 1

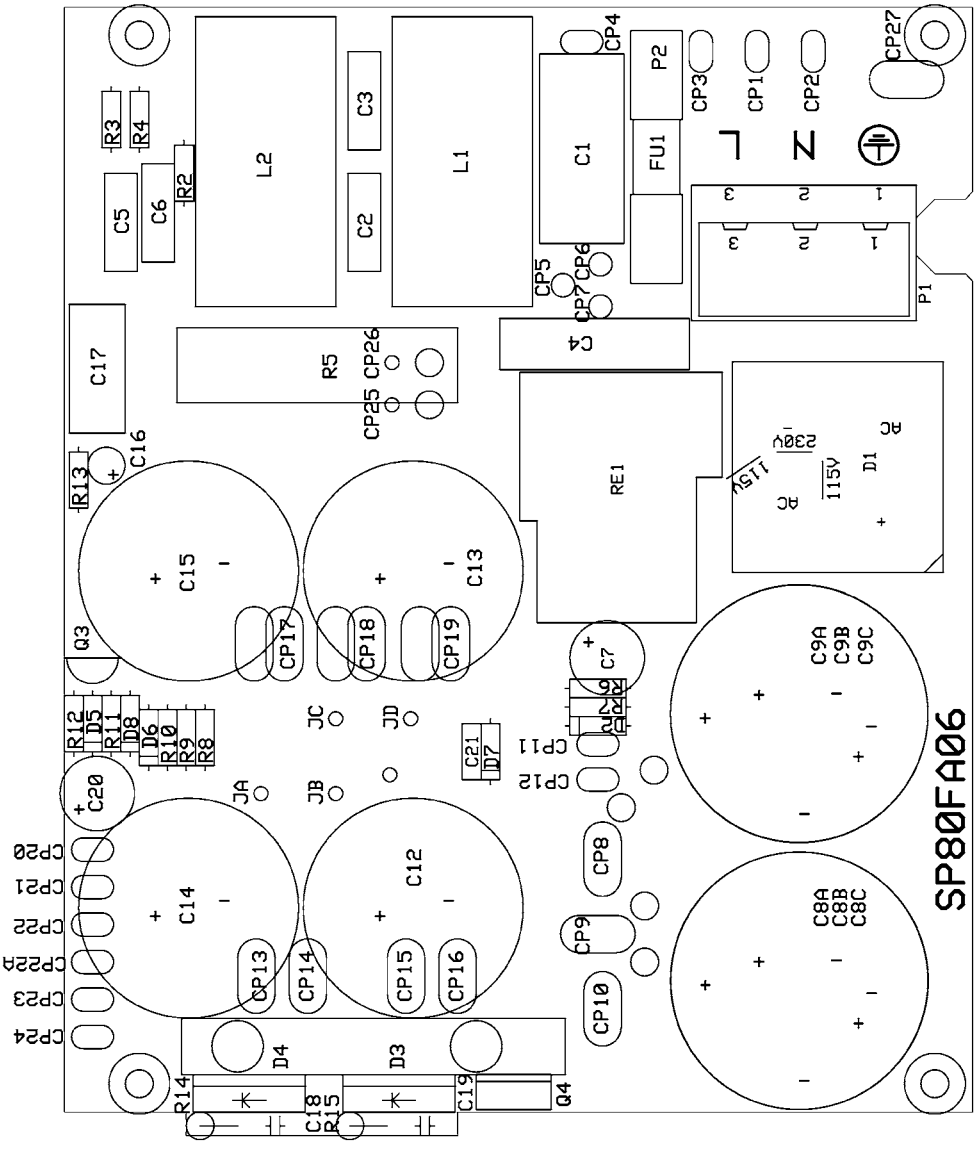



SIGNAL PSU
POWER PSU
CHASSIS
SP80FA
SP80FB
230/115 V AC
SEE INTERNAL CONNECTIONS
SP80F
SWITCH MODE POWERSUPPLY
8kW FLYBACK
DESIGN K.A
DRAWN K.A
CHECKED
REPLACES 01 03 01
DATE 02 04 23
DRAWING NO SP80F01
REPLACED BY
PAGE
U1
OSC.
REF 5V
SOFT START
UVP
OVP
PROTECT
BIAS


SP80FA
SP80FB
SP80FP
SWITCH MODE POWERSUPPLY
8kW FLYBACK POWER INDICATOR
SIGNAL PSU
POWER PSU
CHASSIS
SEE INTERNAL CONNECTIONS
DESIGN K.A
DRAWN K.A
CHECKED
REPLACES 01 03 01
DATE 02 04 23
PAGE
DRAWING NO SP80FP01
REPLACED BY
230/115 V AC
MAINS
OSC.
REF 5V
SOFT START
BIAS
OVP REF3V UVP PROTECT



DESIGN K.A	DRAWN K.A	CHECKED	SP80FA	REPLACES 01 11 23	REPLACED BY
			SWITCH MODE POWERSUPPLY 8kW FLYBACK BOARD A	DATE 02 04 30	PAGE
				DRAWING NO	SP80FA04-P



DESIGN K.A	DRAWN K.A	CHECKED	SP80FA	REPLACES 02 04 30	REPLACED BY
LABGRUPPEN KUNGSBACKA SWEDEN			SWITCH MODE POWERSUPPLY 8kW FLYBACK BOARD A	DATE 02 06 20	PAGE
				DRAWING NO	SP80FA06-P

Component list for SP80FA - rev 06

⚠ - Safety critical component. Should only be replaced with the specified type.

	Position	Partnumber	Description	Comment	Side
⚠	C1	u47X22.5	Capacitor 470n X2 metallized propylene 22.5mm		Top
⚠	C2		Variant dependent, see separate list		Top
⚠	C3		Variant dependent, see separate list		Top
⚠	C4	u22X22.5	Capacitor 220n X2 metallized propylene 22.5mm		Top
⚠	C5		Variant dependent, see separate list		Top
⚠	C6		Variant dependent, see separate list		Top
	C7	100u50V	Capacitor electrolytic 100u 50V 5mm		Top
	C8A		Variant dependent, see separate list		Top
	C8B		Variant dependent, see separate list		Top
	C8C		Variant dependent, see separate list		Top
	C9A		Variant dependent, see separate list		Top
	C9B		Variant dependent, see separate list		Top
	C9C		Variant dependent, see separate list		Top
	C12		Variant dependent, see separate list		Top
	C13		Variant dependent, see separate list		Top
	C14		Variant dependent, see separate list		Top
	C15		Variant dependent, see separate list		Top
	C16	22u50V	Capacitor electrolytic 22u 50V 5mm		Top
⚠	C17	2u2100VMMK15	Capacitor polyester 2u2 100V MMK 15mm		Top
	C18		Variant dependent, see separate list		Top
	C19		Variant dependent, see separate list		Top
	C20	100u50V	Capacitor electrolytic 100u 50V 5mm		Top
	C21		Variant dependent, see separate list		Top
⚠	D1	GBPC35-06	Diode bridge GBPC35-06		Top
	D2	BYV26C	Diode power switch BYV26C		Top
	D3	STTA3006PI	Diode power STTA3006PI standing		Top
	D4	STTA3006PI	Diode power STTA3006PI standing		Top
	D5	5V6.4W2%	Diode zener 5V6 .4W 2%		Top
	D6	62V.4W2%	Diode zener 62V .4W 2%	May have different value	Top
	D7		Variant dependent, see separate list		Top
	D8		Variant dependent, see separate list		Top
⚠	FU1		Variant dependent, see separate list		Top
	JMPR 230V		Variant dependent, see separate list		Top
	JMPR 1 115V		Variant dependent, see separate list		Top
	JMPR 2 115V		Variant dependent, see separate list		Top
	JMPR JB-JC	R04M1.2	Resistor jumper 0R 4modules D1.2mm		Top
	JMPR CP1-CP3		Variant dependent, see separate list		Top
⚠	JMPR CP2-CP4		Variant dependent, see separate list		Top
	JMPR CP5-CP6		Variant dependent, see separate list		Top
⚠	L1		Variant dependent, see separate list		Top
⚠	L2		Variant dependent, see separate list		Top
⚠	P1	TBPC3P4M8	Terminal bloc PCB 3pole 4module 8mm2		Top
	P2	FCPC5x20-6.3x32	Fuse clip combi PCB 5x20 and 6.3x32 mm fuse (2pcs)		Top
	Q3	BC546	Transistor bipolar signal BC546		Top
	Q4		Variant dependent, see separate list		Top
	R2	1M.7W1%	Resistor Metal Film 1M.7W1%		Top
	R3	33R.25W5%	Resistor Carbon Film 33R.25W5%		Top
	R4	33R.25W5%	Resistor Carbon Film 33R.25W5%		Top
⚠	R5		Variant dependent, see separate list		Top

	Position	Partnumber	Description	Comment	Side
	R6	33R.25W5%	Resistor Carbon Film 33R.25W5%		Top
	R7	2R21W5%	Resistor metal film 2R2 1W 5%		Top
	R8		Variant dependent, see separate list	May have different value	Top
	R9		Variant dependent, see separate list	May have different value	Top
	R10	39K.7W1%	Resistor Metal Film 39K.7W1%	May have different value	Top
	R11	18K.7W1%	Resistor Metal Film 18K.7W1%	May have different value	Top
	R12	4K7.7W1%	Resistor Metal Film 4K7.7W1%	May have different value	Top
	R13	4R7.25W5%	Resistor Carbon Film 4R7.25W5%		Top
	R14		Variant dependent, see separate list		Top
	R15		Variant dependent, see separate list		Top
	R16	-	Not used	May have different value	Top
⚠	RE1	PCSPNO40A18V	Relay PCB SPNO 40A 18V	May have different value	Top

Variant specific components for 230V versions - rev 06

	Position	SP80FA-4x6-2	SP80FA-2x13-2	SP80FA-2x17-2	SP80FA-2x32-2
⚠	C2	1n5Y10	1n5Y10	1n5Y10	1n5Y10
⚠	C3	1n5Y10	1n5Y10	1n5Y10	1n5Y10
⚠	C5	1n5Y10	1n5Y10	1n5Y10	1n5Y10
⚠	C6	1n5Y10	1n5Y10	1n5Y10	1n5Y10
	C8A	220u385V35x55PW	220u385V35x55PW	220u385V35x55PW	-
	C8B	-	-	-	1500u200V35x504TSI
	C8C	-	-	-	-
	C9A	220u385V35x55PW	220u385V35x55PW	220u385V35x55PW	-
	C9B	-	-	-	1500u200V35x504TSI
	C9C	-	-	-	-
	C12	3900u100V30x45	3900u100V30x45	1800u160V30x50	1800u160V30x50
	C13	3900u100V30x45	3900u100V30x45	1800u160V30x50	1800u160V30x50
	C14	3900u100V30x45	3900u100V30x45	1800u160V30x50	1800u160V30x50
	C15	3900u100V30x45	3900u100V30x45	1800u160V30x50	1800u160V30x50
	C18	4n7400VMFKT5	4n7400VMFKT5	-	-
	C19	4n7400VMFKT5	4n7400VMFKT5	-	-
	C21	-	-	680p400VK20005%5	680p400VK20005%5
	D7	-	-	15V.4W5%	15V.4W5%
	D8	-	-	39V.4W2%	39V.4W2%
⚠	FU1	T10AH250-5x20	T10AH250-5x20	T10AH250-5x20	T15AH250-6.3x32
	JMPR 230V	R02M.8	R02M.8	R02M.8	R02M.8
	JMPR 1 115V	-	-	-	-
	JMPR 2 115V	-	-	-	-
	JMPR CP1-CP3	-	-	-	R03M.8
⚠	JMPR CP2-CP4	-	-	-	AWG16BLU300VVW1
	JMPR CP5-CP6	R02M.8	R02M.8	R02M.8	-

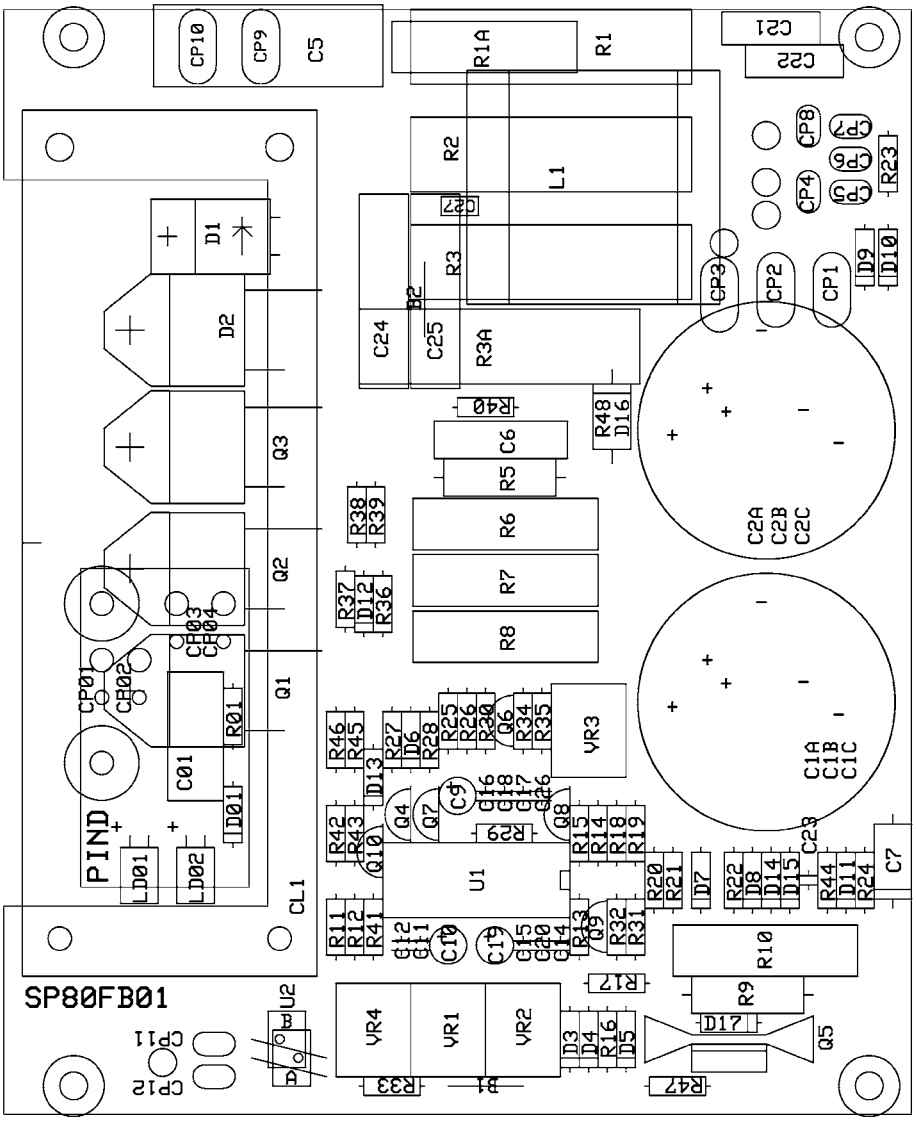
	Position	SP80FA-4x6-2	SP80FA-2x13-2	SP80FA-2x17-2	SP80FA-2x32-2
⚠	L1	2x3m7H8A-LAB	2x3m7H8A-LAB	2x3m7H8A-LAB	2x4m7H16A-LAB
⚠	L2	2x3m7H8A-LAB	2x3m7H8A-LAB	2x3m7H8A-LAB	2x4m7H16A-LAB
	Q4	TIP132	TIP132	IRF730	IRF730
⚠	R5	47R9W5%17MSO5	47R9W5%17MSO5	47R9W5%17MSO5	47R9W5%17MSO5
	R8	4K7.7W1%	8K2.7W1%	27K.7W1%SO5	27K.7W1%SO5
	R9	1M.7W1%	150K.25W5%	180K.7W1%	180K.7W1%
	R14	2R22W5%2MST	2R22W5%2MST	-	-
	R15	2R22W5%2MST	2R22W5%2MST	-	-

Variant specific components for 115V versions - rev 06

	Position	SP80FA-4x6-2U	SP80FA-2x13-2U	SP80FA-2x17-2U	SP80FA-2x32-2U
⚠	C2	2n2Y10	2n2Y10	2n2Y10	2n2Y10
⚠	C3	2n2Y10	2n2Y10	2n2Y10	2n2Y10
⚠	C5	2n2Y10	2n2Y10	2n2Y10	2n2Y10
⚠	C6	2n2Y10	2n2Y10	2n2Y10	2n2Y10
	C8A	-	-	-	-
	C8B	1500u200V35x504TSI	1500u200V35x504TSI	1500u200V35x504TSI	-
	C8C	-	-	-	2200u200V35x55
	C9A	-	-	-	-
	C9B	1500u200V35x504TSI	1500u200V35x504TSI	1500u200V35x504TSI	-
	C9C	-	-	-	2200u200V35x55
	C12	3900u100V30x45	3900u100V30x45	1800u160V30x50	1800u160V30x50
	C13	3900u100V30x45	3900u100V30x45	1800u160V30x50	1800u160V30x50
	C14	3900u100V30x45	3900u100V30x45	1800u160V30x50	1800u160V30x50
	C15	3900u100V30x45	3900u100V30x45	1800u160V30x50	1800u160V30x50
	C18	4n7400VMFKT5	4n7400VMFKT5	-	-
	C19	4n7400VMFKT5	4n7400VMFKT5	-	-
	C21	-	-	680p400VK20005%5	680p400VK20005%5
	D7	-	-	15V.4W5%	15V.4W5%
	D8	-	-	39V.4W2%	39V.4W2%
⚠	FU1	T20AH250-6.3x32	T20AH250-6.3x32	T20AH250-6.3x32	T30AH125-6.3x32
	JMPR 230V	-	-	-	-
	JMPR 1 115V	R02M.8	R02M.8	R02M.8	R02M.8
	JMPR 2 115V	R02M.8	R02M.8	R02M.8	R02M.8
	JMPR CP1-CP3	R03M.8	R03M.8	R03M.8	R03M.8
⚠	JMPR CP2-CP4	AWG16BLU300VVW1	AWG16BLU300VVW1	AWG16BLU300VVW1	AWG16BLU300VVW1
	JMPR CP5-CP6	-	-	-	-
⚠	L1	2x4m7H16A-LAB	2x4m7H16A-LAB	2x4m7H16A-LAB	2x2mH32A-LAB
⚠	L2	2x4m7H16A-LAB	2x4m7H16A-LAB	2x4m7H16A-LAB	2x2mH32A-LAB
	Q4	TIP132	TIP132	IRF730	IRF730
⚠	R5	22R9W5%17MSO5	22R9W5%17MSO5	22R9W5%17MSO5	22R9W5%17MSO5
	R8	4K7.7W1%	8K2.7W1%	27K.7W1%SO5	27K.7W1%SO5
	R9	1M.7W1%	150K.25W5%	180K.7W1%	180K.7W1%
	R14	2R22W5%2MST	2R22W5%2MST	-	-
	R15	2R22W5%2MST	2R22W5%2MST	-	-

Description for variant dependent components

Partnumber	Description
1500u200V35x504TSI	Cap. electrolytic 1500u 200V 35x50mm 4 terminals snap in
150K.25W5%	Resistor Carbon Film 150K.25W5%
15V.4W5%	Diode zener 15V .4W 5%
1800u160V30x50	Capacitor electrolytic 1800u 160V 30x50mm snap in
180K.7W1%	Resistor Metal Film 180K.7W1%
1M.7W1%	Resistor Metal Film 1M.7W1%
1n5Y10	Capacitor 1n5 Y2 metallized paper 10mm
2200u200V35x55	Capacitor electrolytic 2200u 200V 35x45mm snap in
220u385V35x55PW	Cap. electrolytic 220u 385V 35x55mm printed wiring terminals
22R9W5%17MSO5	Resistor wirewound 22R 9W 5% 17modules 5mm stand off
27K.7W1%SO5	Resistor Metal Film 27K.7W1% 5mm stand off
2n2Y10	Capacitor 2n2 Y2 metallized paper 10mm
2R22W5%2MST	Resistor metal film 2R2 2W 5% 2modules standing
2x2mH32A-LAB	Supression choke 2x2mH 32A 2x18 varv 1.8mm LAB. Rev01
2x3m7H8A-LAB	Supression choke 2x3m7H 8A 2x21 varv 1mm LAB. Rev01
2x4m7H16A-LAB	Supression choke 2x4m7H 16A 2x24 varv 1.25mm LAB. Rev01
3900u100V30x45	Capacitor electrolytic 3900u 100V 30x45mm snap in
39V.4W2%	Diode zener 39V .4W 2%
47R9W5%17MSO5	Resistor wirewound 47R 9W 5% 17modules 5mm stand off
4K7.7W1%	Resistor Metal Film 4K7.7W1%
4n7400VMFKT5	Capacitor polyester metal foil 4n7 400V MFKT 5mm
680p400VK20005%5	Capacitor ceramic 680p 400V K2000 5% 5mm
8K2.7W1%	Resistor Metal Film 8K2.7W1%
AWG16BLU300VVW1	Cable AWG16 Blue UL style 1569 VW1
IRF730	Transistor MOS power IRF730
R02M.8	Resistor jumper 0R 2modules D.8mm
R03M.8	Resistor jumper 0R 3modules D.8mm
T10AH250-5x20	Fuse slow blow 10A 250V 1500A IR 5x20mm
T15AH250-6.3x32	Fuse slow blow 15A 250V 1500A IR 6.3x32mm
T20AH250-6.3x32	Fuse slow blow 20A 250V 10000A IR 6.3x32mm
T30AH125-6.3x32	Fuse slow blow 30A 125V 400A IR 6.3x32mm
TIP132	Transistor bipolar power TIP132



DESIGN	DRAWN	CHECKED	SP80FB	REPLACES 01 11 23	REPLACED BY
K.A	K.A		SWITCH MODE POWERSUPPLY 8kW FLYBACK BOARD B	DATE 02 04 23	PAGE
				DRAWING NO	SP80FB01-P

Component list for PIND, SP80FB - rev 01A

⚠ - Safety critical component. Should only be replaced with the specified type.

	Position	Partnumber	Description	Comment	Side
	C01		Variant dependent, see separate list		Top
	C1A		Variant dependent, see separate list		Top
	C1B		Variant dependent, see separate list		Top
	C1C		Variant dependent, see separate list		Top
	C2A		Variant dependent, see separate list		Top
	C2B		Variant dependent, see separate list		Top
	C2C		Variant dependent, see separate list		Top
⚠	C5	u68X27.5	Capacitor 680n X2 metallized propylene 27.5mm		Top
	C6		Variant dependent, see separate list		Top
	C7	10u63V6x10A	Capacitor electrolytic 10u 63V 6x10mm axial		Top
	C9	10u50V	Capacitor electrolytic 10u 50V 5mm		Top
	C10	22u50V	Capacitor electrolytic 22u 50V 5mm		Top
	C11	470p200VNP05%5	Capacitor ceramic 470p 200V NP0 5% 5mm		Top
	C12	1n250VMMK5	Capacitor polyester 1n 250V MMK 5mm		Top
	C14	10n250VMMK5	Capacitor polyester 10n 250V MMK 5mm		Top
	C15	330p200VNP05%5	Capacitor ceramic 330p 200V NP0 5% 5mm		Top
	C16	330p200VNP05%5	Capacitor ceramic 330p 200V NP0 5% 5mm		Top
	C17	-	Not used		Top
	C18	1n250VMMK5	Capacitor polyester 1n 250V MMK 5mm		Top
	C19	10u50V	Capacitor electrolytic 10u 50V 5mm		Top
	C20	-	Not used		Top
⚠	C21		Variant dependent, see separate list		Top
⚠	C22		Variant dependent, see separate list		Top
	C23	1n250VMMK5	Capacitor polyester 1n 250V MMK 5mm		Top
⚠	C24		Variant dependent, see separate list		Top
⚠	C25		Variant dependent, see separate list		Top
	C26	1n250VMMK5	Capacitor polyester 1n 250V MMK 5mm		Top
	C27		Variant dependent, see separate list		Top
	D01		Variant dependent, see separate list		Top
	D1	BYT12PI1000LY	Diode power BYT12PI1000 lying		Bot.
	D2		Variant dependent, see separate list		Bot.
	D3	15V1.3W5%	Diode zener 15V 1.3W 5%		Top
	D4	5V6.4W2%	Diode zener 5V6 .4W 2%		Top
	D5	1N4148	Diode signal 1N4148		Top
	D6	BYV26C	Diode power switch BYV26C		Top
	D7	1N4004	Diode power 1N4004		Top
	D8	1N4148	Diode signal 1N4148		Top
	D9	1N4148	Diode signal 1N4148		Top
	D10	1N4148	Diode signal 1N4148		Top
	D11	BYV26C	Diode power switch BYV26C		Top
	D12	BZW06P15B	Diode transient voltage suppression BZW06P15B		Top
	D13	BAT85	Diode signal BAT85		Top
	D14	1N4148	Diode signal 1N4148		Top
	D15		Variant dependent, see separate list		Top
	D16		Variant dependent, see separate list		Top
	D17		Variant dependent, see separate list		Top
⚠	L1		Variant dependent, see separate list		Top
	LD01		Variant dependent, see separate list		Top
	LD02		Variant dependent, see separate list		Top
	Q1	-	Not used	May have different value	Bot.

	Position	Partnumber	Description	Comment	Side
	Q2	SGW25N120LY	Transistor IGBT power SGW25N120 lying	May have different value	Bot.
	Q3	SGW25N120LY	Transistor IGBT power SGW25N120 lying	May have different value	Bot.
	Q4	BC327	Transistor bipolar signal BC327		Top
	Q5	TIP50	Transistor bipolar power TIP50		Top
	Q6	BC547B	Transistor bipolar signal BC547B		Top
	Q7	R01M.6 (b-e)	Resistor jumper 0R 1module D.6mm		Top
	Q8	BC557B	Transistor bipolar signal BC557B		Top
	Q9		Variant dependent, see separate list		Top
	Q10		Variant dependent, see separate list		Top
	R01		Variant dependent, see separate list		Top
	R1		Variant dependent, see separate list		Top
	R1A	-	Not used		Top
	R2		Variant dependent, see separate list		Top
	R3		Variant dependent, see separate list		Top
	R3A	-	Not used		Top
	R5		Variant dependent, see separate list		Top
	R6	R104W10%SO5	Resistor wirewound R10 4W 10% 5mm stand off		Top
	R7	R104W10%SO5	Resistor wirewound R10 4W 10% 5mm stand off		Top
	R8	R104W10%SO5	Resistor wirewound R10 4W 10% 5mm stand off		Top
	R9		Variant dependent, see separate list		Top
	R10	4K77W5%10MSO5	Resistor wirewound 4K7 7W 5% 10modules 5mm stand off		Top
	R11	680K.25W5%	Resistor Carbon Film 680K.25W5%		Top
	R12	33K.7W1%	Resistor Metal Film 33K.7W1%		Top
	R13	270K.7W1%	Resistor Metal Film 270K.7W1%		Top
	R14	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R15	18K.7W1%	Resistor Metal Film 18K.7W1%		Top
	R16	180R.7W1%	Resistor Metal Film 180R.7W1%		Top
	R17	120K2W5%SO5	Resistor metal film 120K 2W 5% 5mm stand off		Top
	R18	10K.7W1%	Resistor Metal Film 10K.7W1%		Top
	R19		Variant dependent, see separate list		Top
	R20	432K1W1%	Resistor Metal Film 432K 1W 1%		Top
	R21	750K.7W1%	Resistor Metal Film 750K.7W1%		Top
	R22	4R7.25W5%	Resistor Carbon Film 4R7.25W5%		Top
	R23		Variant dependent, see separate list		Top
	R24	4R7.25W5%	Resistor Carbon Film 4R7.25W5%		Top
	R25	15K.7W1%	Resistor Metal Film 15K.7W1%		Top
	R26	1K.7W1%	Resistor Metal Film 1K.7W1%		Top
	R27		Variant dependent, see separate list		Top
	R28	82R.25W5%	Resistor Carbon Film 82R.25W5%		Top
	R29	4M7.25W5%	Resistor Carbon Film 4M7.25W5%		Top
	R30		Variant dependent, see separate list		Top
	R31	220K.7W1%	Resistor Metal Film 220K.7W1%		Top
	R32		Variant dependent, see separate list		Top
	R33		Variant dependent, see separate list		Top
	R34		Variant dependent, see separate list		Top
	R35		Variant dependent, see separate list		Top
	R36	15K.7W1%	Resistor Metal Film 15K.7W1%		Top
	R37		Variant dependent, see separate list		Top
	R38		Variant dependent, see separate list		Top
	R39		Variant dependent, see separate list		Top
	R40		Variant dependent, see separate list		Top
	R41	18K.7W1%	Resistor Metal Film 18K.7W1%		Top
	R42	-	Not used		Top

	Position	Partnumber	Description	Comment	Side
	R43	R04M.6	Resistor jumper 0R 4modules D.6mm		Top
	R44		Variant dependent, see separate list		Top
	R45		Variant dependent, see separate list		Top
	R46		Variant dependent, see separate list		Top
	R47		Variant dependent, see separate list		Top
	R48		Variant dependent, see separate list		Top
⚠	S1	TP1-0-5A3x8x21	Thermal protector Single Pole Single Trough on - off 5A 3x8x21mm		Bot.
	U1	UC3851	IC PWM UC3851		Top
⚠	U2A		Variant dependent, see separate list	May have different value	Top
	U2B		Variant dependent, see separate list		Top
	VR1	VR10KLY2X3M	Trimpotentiometer 10K lying 2x3modules		Top
	VR2	VR22KLY2X3M	Trimpotentiometer 22K lying 2x3modules		Top
	VR3	VR10KLY2X3M	Trimpotentiometer 10K lying 2x3modules		Top
	VR4	15K.7W1%	Resistor Metal Film 15K.7W1%		Top

Variant specific components for 230V versions - rev 01A

	Position	SP80FB-4x6-2	SP80FB-2x11-2	SP80FB-2x13-2	SP80FB-2x17-2	SP80FB-2x32-2
	C01	-	-	-	-	100n400VMMK15
	C1A	220u385V35x55PW	220u385V35x55PW	220u385V35x55PW	220u385V35x55PW	-
	C1B	-	-	-	-	1500u200V35x504 TSI
	C1C	-	-	-	-	-
	C2A	220u385V35x55PW	220u385V35x55PW	220u385V35x55PW	220u385V35x55PW	-
	C2B	-	-	-	-	1500u200V35x504 TSI
	C2C	-	-	-	-	-
	C6	-	-	-	-	1n1250VMKP15
⚠	C21	1n5Y10	1n5Y10	1n5Y10	1n5Y10	1n5Y10
⚠	C22	1n5Y10	1n5Y10	1n5Y10	1n5Y10	1n5Y10
⚠	C24	-	-	-	-	22n1000VMKP22.5
⚠	C25	-	-	-	-	22n1000VMKP22.5
	C27	100p1600VFKP15	100p1600VFKP15	100p1600VFKP15	100p1600VFKP15	-
	D01	-	-	-	-	1N4148
	D2	-	-	-	-	STTA1512PILY
	D15	43V.4W2%	43V.4W2%	39V.4W2%	43V.4W2%	43V.4W2%
	D16	-	-	-	-	BYM26E
	D17	-	-	-	-	1N4148
⚠	L1	-	-	-	-	400uHEFD30_LAB
	LD01	-	-	-	-	LYEL2.5x5LY
	LD02	-	-	-	-	LGRN2.5x5LY
	Q9	R01M.6 (b-c)	-	R01M.6 (b-c)	-	BC557B
	Q10	-	-	-	-	BC547B
	R01	-	-	-	-	4K7.7W1%
	R1	18K9W5%17MSO5	18K9W5%17MSO5	18K9W5%17MSO5	18K9W5%17MSO5	33K9W5%17MSO5
	R2	18K9W5%17MSO5	18K9W5%17MSO5	18K9W5%17MSO5	18K9W5%17MSO5	-
	R3	18K9W5%17MSO5	18K9W5%17MSO5	18K9W5%17MSO5	18K9W5%17MSO5	-
	R5	-	-	-	-	330R2W5%SO5
	R9	1K52W5%SO5	1K52W5%SO5	1K52W5%SO5	1K52W5%SO5	1K3W5%SO5
	R19	5K62.7W1%	5K62.7W1%	5K62.7W1%	5K62.7W1%	5K9.7W1%
	R23	8K2.7W1%	6K8.7W1%	6K8.7W1%	6K8.7W1%	6K8.7W1%

	Position	SP80FB-4x6-2	SP80FB-2x11-2	SP80FB-2x13-2	SP80FB-2x17-2	SP80FB-2x32-2
	R27	4R7.25W5%	4R7.25W5%	4R7.25W5%	4R7.25W5%	R04M.6
	R30	56K.7W1%	56K.7W1%	56K.7W1%	56K.7W1%	180K.7W1%
	R32	133K.7W1%	88K7.7W1%	169K.7W1%	88K7.7W1%	88K7.7W1%
	R33	270K.7W1%	-	330K.7W1%	-	1K.7W1%
	R34	2K2.7W1%	2K2.7W1%	2K2.7W1%	2K2.7W1%	2K4.7W1%
	R35	4K7.7W1%	4K7.7W1%	4K7.7W1%	4K7.7W1%	3K3.7W1%
	R37	4R7.25W5%	4R7.25W5%	4R7.25W5%	4R7.25W5%	2R2.25W5%
	R38	4R7.25W5%	4R7.25W5%	4R7.25W5%	4R7.25W5%	2R2.25W5%
	R39	4R7.25W5%	4R7.25W5%	4R7.25W5%	4R7.25W5%	2R2.25W5%
	R40	1M.7W1%	1M.7W1%	1M.7W1%	1M.7W1%	1M2.7W1%
	R44	470R.25W5%	470R.25W5%	470R.25W5%	470R.25W5%	560R.25W5%
	R45	-	-	-	-	698R.7W1%
	R46	-	-	-	-	196R.7W1%
	R47	-	-	-	-	820R.25W5%
	R48	2R22W5%SO5	2R22W5%SO5	2R22W5%SO5	2R22W5%SO5	-
⚠	U2A	TCET1102G	-	TCET1102G	-	R04M.6 (2-4)
	U2B	-	-	-	-	R04M.6 (1-5)

Variant specific components for 115V versions - rev 01A

	Position	SP80FB-4x6-2U	SP80FB-2x11-2U	SP80FB-2x13-2U	SP80FB-2x17-2U	SP80FB-2x32-2U
	C01	-	-	-	-	220n250VMMK15
	C1A	-	-	-	-	-
	C1B	1500u200V35x504 TSI	1500u200V35x504 TSI	1500u200V35x504 TSI	1500u200V35x504 TSI	-
	C1C	-	-	-	-	2200u200V35x55
	C2A	-	-	-	-	-
	C2B	1500u200V35x504 TSI	1500u200V35x504 TSI	1500u200V35x504 TSI	1500u200V35x504 TSI	-
	C2C	-	-	-	-	2200u200V35x55
	C6	-	-	-	-	1n1250VMKP15
⚠	C21	2n2Y10	2n2Y10	2n2Y10	2n2Y10	2n2Y10
⚠	C22	2n2Y10	2n2Y10	2n2Y10	2n2Y10	2n2Y10
⚠	C24	-	-	-	-	22n1000VMKP22.5
⚠	C25	-	-	-	-	22n1000VMKP22.5
	C27	100p1600VFKP15	100p1600VFKP15	100p1600VFKP15	100p1600VFKP15	-
	D01	-	-	-	-	1N4148
	D2	-	-	-	-	STTA1512PILY
	D15	43V.4W2%	43V.4W2%	39V.4W2%	43V.4W2%	43V.4W2%
	D16	-	-	-	-	BYM26E
	D17	-	-	-	-	1N4148
⚠	L1	-	-	-	-	400uHEFD30_LAB
	LD01	-	-	-	-	LYEL2.5x5LY
	LD02	-	-	-	-	LGRN2.5x5LY
	Q9	R01M.6 (b-c)	-	R01M.6 (b-c)	-	BC557B
	Q10	-	-	-	-	BC547B
	R01	-	-	-	-	4K7.7W1%
	R1	18K9W5%17MSO5	18K9W5%17MSO5	18K9W5%17MSO5	18K9W5%17MSO5	33K9W5%17MSO5
	R2	18K9W5%17MSO5	18K9W5%17MSO5	18K9W5%17MSO5	18K9W5%17MSO5	-
	R3	18K9W5%17MSO5	18K9W5%17MSO5	18K9W5%17MSO5	18K9W5%17MSO5	-
	R5	-	-	-	-	330R2W5%SO5

	Position	SP80FB-4x6-2U	SP80FB-2x11-2U	SP80FB-2x13-2U	SP80FB-2x17-2U	SP80FB-2x32-2U
	R9	1K52W5%SO5	1K52W5%SO5	1K52W5%SO5	1K52W5%SO5	1K3W5%SO5
	R19	5K62.7W1%	5K62.7W1%	5K62.7W1%	5K62.7W1%	5K9.7W1%
	R23	8K2.7W1%	6K8.7W1%	6K8.7W1%	6K8.7W1%	6K8.7W1%
	R27	4R7.25W5%	4R7.25W5%	4R7.25W5%	4R7.25W5%	R04M.6
	R30	56K.7W1%	56K.7W1%	56K.7W1%	56K.7W1%	180K.7W1%
	R32	133K.7W1%	88K7.7W1%	169K.7W1%	88K7.7W1%	88K7.7W1%
	R33	270K.7W1%	-	330K.7W1%	-	1K.7W1%
	R34	2K2.7W1%	2K2.7W1%	2K2.7W1%	2K2.7W1%	2K4.7W1%
	R35	4K7.7W1%	4K7.7W1%	4K7.7W1%	4K7.7W1%	3K3.7W1%
	R37	4R7.25W5%	4R7.25W5%	4R7.25W5%	4R7.25W5%	2R2.25W5%
	R38	4R7.25W5%	4R7.25W5%	4R7.25W5%	4R7.25W5%	2R2.25W5%
	R39	4R7.25W5%	4R7.25W5%	4R7.25W5%	4R7.25W5%	2R2.25W5%
	R40	1M.7W1%	1M.7W1%	1M.7W1%	1M.7W1%	1M2.7W1%
	R44	470R.25W5%	470R.25W5%	470R.25W5%	470R.25W5%	560R.25W5%
	R45	-	-	-	-	698R.7W1%
	R46	-	-	-	-	196R.7W1%
	R47	-	-	-	-	820R.25W5%
	R48	2R22W5%SO5	2R22W5%SO5	2R22W5%SO5	2R22W5%SO5	-
⚠	U2A	TCET1102G	-	TCET1102G	-	R04M.6 (2-4)
	U2B	-	-	-	-	R04M.6 (1-5)

Description for variant dependent components

Partnumber	Description
100n400VMMK15	Capacitor polyester 100n 400V MMK 15mm
100p1600VFKP15	Capacitor polypropylene 100p 1600V FKP 15mm
133K.7W1%	Resistor Metal Film 133K.7W1%
1500u200V35x504TSI	Cap. electrolytic 1500u 200V 35x50mm 4 terminals snap in
169K.7W1%	Resistor Metal Film 169K.7W1%
180K.7W1%	Resistor Metal Film 180K.7W1%
18K9W5%17MSO5	Resistor wirewound 18K 9W 5% 17modules 5mm stand off
196R.7W1%	Resistor Metal Film 196R.7W1%
1K.7W1%	Resistor Metal Film 1K.7W1%
1K3W5%SO5	Resistor metal film 1K 3W 5% 5mm stand off
1K52W5%SO5	Resistor metal film 1K5 2W 5% 5mm stand off
1M.7W1%	Resistor Metal Film 1M.7W1%
1M2.7W1%	Resistor Metal Film 1M2.7W1%
1n1250VMKP15	Capacitor polypropylene 1n 1250V MKP 15mm
1N4148	Diode signal 1N4148
1n5Y10	Capacitor 1n5 Y2 metallized paper 10mm
2200u200V35x55	Capacitor electrolytic 2200u 200V 35x45mm snap in
220n250VMMK15	Capacitor polyester 220n 250V MMK 15mm
220u385V35x55PW	Cap. electrolytic 220u 385V 35x55mm printed wiring terminals
22n1000VMKP22.5	Capacitor polypropylene 22n 1000V MKP 22.5mm
270K.7W1%	Resistor Metal Film 270K.7W1%
2K2.7W1%	Resistor Metal Film 2K2.7W1%
2K4.7W1%	Resistor Metal Film 2K4.7W1%
2n2Y10	Capacitor 2n2 Y2 metallized paper 10mm
2R2.25W5%	Resistor Carbon Film 2R2.25W5%
2R22W5%SO5	Resistor metal film 2R2 2W 5% 5mm stand off
330K.7W1%	Resistor Metal Film 330K.7W1%

330R2W5%SO5	Resistor metal film 330R 2W 5% 5mm stand off
33K9W5%17MSO5	Resistor wirewound 33K 9W 5% 17modules 5mm stand off
39V.4W2%	Diode zener 39V .4W 2%
3K3.7W1%	Resistor Metal Film 3K3.7W1%
400uHEFD30_LAB	Inductor 400uH EFD30 LAB.GRUPPEN Rev 01
43V.4W2%	Diode zener 43V .4W 2%
470R.25W5%	Resistor Carbon Film 470R.25W5%
4K7.7W1%	Resistor Metal Film 4K7.7W1%
4R7.25W5%	Resistor Carbon Film 4R7.25W5%
560R.25W5%	Resistor Carbon Film 560R.25W5%
56K.7W1%	Resistor Metal Film 56K.7W1%
5K62.7W1%	Resistor Metal Film 5K62.7W1%
5K9.7W1%	Resistor Metal Film 5K9.7W1%
698R.7W1%	Resistor Metal Film 698R.7W1%
6K8.7W1%	Resistor Metal Film 6K8.7W1%
820R.25W5%	Resistor Carbon Film 820R.25W5%
88K7.7W1%	Resistor Metal Film 88K7.7W1%
8K2.7W1%	Resistor Metal Film 8K2.7W1%
BC547B	Transistor bipolar signal BC547B
BC557B	Transistor bipolar signal BC557B
BYM26E	Diode power switch BYM26E
LGRN2.5x5LY	Diode LED Green 2.5x5mm lying
LYEL2.5x5LY	Diode LED Yellow 2.5x5mm lying
R01M.6 (b-c)	Resistor jumper 0R 1module D.6mm
R04M.6	Resistor jumper 0R 4modules D.6mm
R04M.6 (1-5)	Resistor jumper 0R 4modules D.6mm
R04M.6 (2-4)	Resistor jumper 0R 4modules D.6mm
STTA1512PILY	Diode power STTA1512PI lying
TCET1102G	IC photocoupler TCET1102G